DOCUMENT RESUME

ED 067 500 VT 016 720

TITLE Testimony of Nationally Representative Groups. U.S. Metric Study Interim Report.
INSTITUTION National Bureau of Standards (DOC), Washington, D.C.
REPORT NO NBS-SP-345-12
PUB DATE Jul 71
NOTE 173p.
AVAILABLE FROM Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (No. c13.10:345-12, $1.50)

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS *Conference Reports; Consumer Education; Educational Needs; *Industrial Education; Measurement; *Metric System; National Surveys; *Number Systems; *Organizations (Groups); Retraining; Standards; Systems Development
IDENTIFIERS Public Law 90 472

ABSTRACT

As the 12th in a series of interim reports prepared for the United States Congress on the metric system, this study was authorized by law to reduce uncertainties concerning the issue of converting to metrication and to provide a better basis upon which the Congress may evaluate and resolve it. The testimony of over 230 nationally representative groups is summarized, supplemented by information from experts in the areas of consumer activity and education. Over 700 trade associations, labor unions, professional societies, and other groups were invited to submit their opinions and cost-benefit estimates concerning a possible future conversion to the metric system. The organizational summaries are grouped into seven categories: (1) labor, (2) consumer affairs, (3) education, (4) construction, (5) engineering-related industry, (6) consumer-related industry, and (7) natural resources, transportation, health, small business, and others. The advantages and disadvantages associated with conversion include international standardization, consumer and industrial retraining and education, changing to new tools, and cost. However, 112 of these groups feel that a changeover is inevitable and desirable, although the complexity of the construction industry would require special planning. A majority of these groups favor a nationally coordinated program with some governmental assistance. (AG)

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U.S. METRIC STUDY
INTERIM REPORT

ED 067500

TESTIMONY OF NATIONALLY REPRESENTATIVE GROUPS

U.S. METRIC STUDY

U.S.
DEPARTMENT
OF
COMMERCE
National
Bureau
of
Standards
NBS SP 345-12

VT016720

U.S. METRIC SUBSTUDY REPORTS

The results of substudies of the U.S. Metric Study, while being evaluated for the preparation of a comprehensive report to the Congress, are being published in the interim as a series of NBS Special Publications. The titles of the individual reports are listed below.

REPORTS ON SUBSTUDIES

NBS SP345-1: International Standards (issued December 1970, SD Catalog No. C13.10:345-1, Price $1.25)

NBS SP345-2: Federal Government: Civilian Agencies (issued July 1971, SD Catalog No. C13.10:345-2, price $2.25)

NBS SP345-3: Commercial Weights and Measures (issued July 1971, SD Catalog No. C13.10:345-3, price $1.00)

NBS SP345-4: The Manufacturing Industry (issued July 1971, SD Catalog No. C13.10:345-4, price $1.25)

NBS SP345-5: Nonmanufacturing Businesses (in press)

NBS SP345-6: Education (in press)

NBS SP345-7: The Consumer (in press)

NBS SP345-8: International Trade (in press)

NBS SP345-9: Department of Defense (issued July 1971, SD Catalog No. C13.10:345-9, price $1.25)

NBS SP345-10: A History of the Metric System Controversy in the United States (in press)

NBS SP345-11: Engineering Standards (issued July 1971, SD Catalog No. C13.10:345-11, price $2.00)

NBS SP345-12: Testimony of Nationally Representative Groups (this publication)

COMPREHENSIVE REPORT ON THE U.S. METRIC STUDY

NBS SP345: To be published in August 1971

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U.S. METRIC STUDY INTERIM REPORT

TESTIMONY OF NATIONALLY REPRESENTATIVE GROUPS

**Twelfth in a series of reports prepared
for the Congress**

U.S. METRIC STUDY
Daniel V. De Simone, Director

National Bureau of Standards
Special Publication 345-12

UNITED STATES DEPARTMENT OF COMMERCE
Maurice H. Stans, *Secretary*
NATIONAL BUREAU OF STANDARDS
Lewis M. Branscomb, *Director*

Nat. Bur. Stand. (U.S.), Spec. Publ. 345-12, 180 pages (July 1971)
CODEN: XNBSA

Issued July 1971

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.10:345-12), Price $1.50
Stock Number 0303-0865

LETTER OF TRANSMITTAL

THE HONORABLE PRESIDENT OF THE SENATE
THE HONORABLE SPEAKER OF THE HOUSE OF REPRESENTATIVES

SIRS:

I have the honor to present the twelfth in the series of interim reports stemming from the U.S. Metric Study, prepared by the National Bureau of Standards.

This Study was authorized by Public Law 90-472 to reduce the many uncertainties concerning the metric issue and to provide a better basis upon which the Congress may evaluate and resolve it.

I shall make a final report to the Congress on this Study in August 1971. In the meantime, the data and opinions contained in this interim report are being evaluated by the Study team at the National Bureau of Standards. My final report to you will reflect this evaluation.

Respectfully submitted,

Maurice H. Stans

Secretary of Commerce

Enclosure

LETTER OF TRANSMITTAL

Honorable Maurice H. Stans
Secretary of Commerce

Dear Mr. Secretary:

I have the honor to transmit to you another interim report of the U.S. Metric Study, which is being conducted at the National Bureau of Standards at your request and in accordance with the Metric Study Act of 1968.

The Study is exploring the subjects assigned to it with great care. We have tried to reach every relevant sector of the society to elicit their views on the metric issue and their estimates of the costs and benefits called for in the Metric Study Act. Moreover, all of these sectors were given an opportunity to testify in the extensive series of Metric Study Conferences that were held last year.

On the basis of all that we have been able to learn from these conferences, as well as the numerous surveys and investigations, a final report will be made to you before August 1971 for your evaluation and decision as to any recommendations that you may wish to make to the Congress.

The attached interim report includes data and other opinions that are still being evaluated by us to determine their relationship and significance to all of the other information that has been elicited by the Study. All of these evaluations will be reflected in the final report.

Sincerely,

Lewis M. Branscomb

Lewis M. Branscomb, *Director*
National Bureau of Standards

Enclosure

FOREWORD

This report summarizes the testimony of nationally representative groups that were asked for their opinions and cost-benefit estimates concerning a possible changeover to the metric system. This opportunity for widespread participation in the U.S. Metric Study was provided through an extensive series of hearings, called "National Metric Study Conferences," that was held during 1970.

Over 700 major national groups were invited to submit their views and cost-benefit estimates of a metric changeover for their sectors. Many of these groups responded, and although few of them were able to make such estimates, we are grateful to all who participated in this effort and made this report possible.

Reports covering other substudies of the U.S. Metric Study are listed on the inside front cover. All of these, including this report, are under evaluation. Hence, they are published without prejudice to the comprehensive report on the entire U.S. Metric Study, which will be sent to the Congress by the Secretary of Commerce in August of 1971.

This report was prepared under the direction of Jeffrey V. Odom, who coordinated the National Metric Study Conferences upon which the report is based. Assisting him in various phases of this effort were Bruce D. Rothrock, Robert W. Carson, Roy E. Clark, Joseph D. Crumlish, Mrs. Linda J. Luhn, Miss Jean M. Simon, Miss Debora L. Gilbert and Mrs. Evelyn B. Tallerico.

In this as in all aspects of the U.S. Metric Study, the program has benefited from the independent judgment and thoughtful counsel of its advisory panel, and the many other organizations, groups, and committees that have participated in the study.

Daniel V. De Simone, *Director*
U.S. Metric Study

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I. SUMMARY

Trade associations, labor unions, professional societies, and other groups were invited to submit their opinions and cost-benefit estimates concerning a possible future conversion to the metric system on behalf of their membership to the U.S. Metric Study to supplement the information collected by its individual surveys and investigations. Their participation, in addition to supplying a valuable input to the Study, also provided the widespread participation of such groups directed by the Metric Study Act.

Over 700 groups were so invited, and inputs were received from over 230 groups representing 674,000 firms and 19,600,000 individuals. These were supplemented by inputs from experts in areas of consumer activity and education. The inputs from these groups are summarized below.

CURRENT METRIC USAGE

Many contributions report little significant usage of metric units, but two-thirds of the reports indicate some metric usage, usually in research-related activities. The extent of present metric usage can be shown by some examples which are given:

Industries with sales or manufacturing activities overseas use metric units in engineering drawings and in sales brochures.

Calculations in electrical and electronic industries are metric, since our present electrical units are identical with metric electrical units.

Elementary and high schools use metric units in science courses. In some recently developed courses, metric is used exclusively.

Nearly all research in science has been metric for years. Laboratory work in health and nutrition, physics, chemistry, and biology is almost exclusively metric. Many engineering disciplines are customary but they are under increasing pressure to convert to the metric system.

The pharmaceutical industry converted to the metric system 15 years ago for closer coordination with research, increased accuracy in medication, and for sales to world markets. Their experience was that the conversion was easier and less costly than anticipated.

Many imported automobiles, engines, and transmissions are made to metric standards, and repair mechanics use metric tools which are readily available.

In parts of the ball bearing industry, two-thirds of the production is made to metric dimensions today, and the proportion is increasing.

The fastener industry recently began work on a "fresh start" for threaded fasteners to combine the best features of customary and metric threads.

FEELINGS ABOUT METRICATION

A strong majority (112) of those groups indicating a preference say that a change to the metric system is inevitable and/or desirable. Only 15 feel it is not inevitable and are opposed to a change; 108 indicate that it would not affect their activities if we did—or did not—change our measurement system.

A majority of those groups favoring metrication as inevitable or desirable prefer such a program to be carried out on a nationally coordinated basis. One hundred and ten groups prefer planned metrication; only three favor metrication proceeding with no national coordination; 122 offer no comment. Many groups, however, indicate that some governmental action would be necessary to permit the close collaboration essential for producers, customers, and suppliers to work together in setting priorities and time schedules.

ADVANTAGES OF METRIC USAGE

Advantages to be achieved by conversion to the metric system which are most often cited include the fact that the metric system is easy to learn, remember, and understand, and would lead to simpler calculations which would reduce the chance of error and save time in computations.

Other advantages of a change to the metric system include the opportunity for design improvement during changeover and the elimination of needless sizes and types of products. Many groups feel conversion would improve the exchange of goods and ideas around the world. Specifically they feel that it would lead to wider markets for exported products, worldwide interchangeability, and a wider range of choice from imports.

COST OF CONVERSION

Transition problems appear significant in three areas: where metrication would require substantial redesign, modification or replacement of manufacturing equipment and manufactured products; where additional stocks of materials and repair parts would be needed; and in consumer education.

Major costs would arise from converting production equipment to make metric parts and products. Costs would be minimized if the transition time were long enough that tools and equipment could be replaced when worn-out or obsolete. In some industries 5 years would be long enough; in others it might take 15 years or longer. Most reports, however, indicate that a 10-year transition would cut these costs to a minimum.

Additional inventories would be required during the transition and for years more in some situations, and careful coordination would be needed to minimize costs. Service needs on long-life equipment such as machine tools and major appliances might run many years beyond the end of the conversion period. Repairs to buildings might also call for continuing small-scale production of present customary-sized supplies for years.

Larger one-time transition costs would include the conversion of engineering drawings, repair manuals, and sales literature for products changed over to metric units. Engineering standards and design tables would have to be revised before new metric products could be made. Manpower required for these steps could lead to temporary added costs during transition.

Much existing legislation, codes, and statutes would need to be revised. School textbooks are usually revised about every 5 years, and a change to the metric system would not add to costs in a 5- to 10-year transition. Traffic signs and road markers could be converted over a year or two, but speed limit signs would have to be changed overnight. Land titles could be converted on a go-forward basis when property changes hands.

WORKER CONCERNS: RETRAINING AND TOOLS

Production workers who are machine tenders would need no special training other than what they would receive as consumers. But maintenance men and service employees would need basic training in the metric system and would also need to obtain some new metric tools. Some skilled workers would need more training and would face greater expenses for worker-owned metric tools.

Some office workers would need metric training. Retail store clerks must be trained to assist customers in purchasing metric-based products. Teachers would need special in-service training to prepare them for metric instruction.

The AFL-CIO takes a firm stand that metrication programs should include reimbursement of workers for the cost of metric tools they must buy, and must also provide training needed at no cost to the worker. Special consideration must also be given to the older workers who might have a more difficult time learning the new system so that no worker would be discharged or passed over for promotion due to his or her inability to quickly grasp the metric system.

THE CONSUMER

Expert testimony generally agrees that in the long run the consumer would benefit from conversion to the metric system. The major difficulty in the consumer area would quite likely be in education.

Many groups from all sectors of the economy comment on the need for a broad plan of consumer and public education in the metric system. Workers receiving training on the job would learn metric as it relates to their jobs, but a massive public education program would be needed to reach other consumers.

An advertising campaign to teach the metric system on TV and in magazines could be used. Public museums would be ready to provide displays on the metric system and its advantages. Vocational schools would be equipped and prepared for consumer classes as well as for up-grading workers.

FORMAL EDUCATION

Experience in teaching the metric system shows that it is easier to teach and learn than the customary system. There would be problems in teacher retraining and textbook conversion, but these are generally regarded as minor and far outweighed by the overall advantages which would be realized.

THE CONSTRUCTION INDUSTRY

The construction industry is extremely complex and any conversion would require careful coordination in order to minimize problems. Most groups see little direct benefit to the industry from conversion, but many feel that it would present an ideal opportunity to advance the concept of modular construction and thus achieve important cost savings. A special problem for the industry would be the need to repair and remodel existing structures which would require added inventories to be maintained for many years.

AGRICULTURE, FORESTRY, FISHERIES AND MINING

Farmers expect no advantages in metrication, but expect little disruption if adequate education precedes any change. The major impact on agriculture would be the confusion and inconvenience of learning to think in a new system. Foresters expect a changeover to lead to a better system of measuring timber, but changes in land measurement could be a problem and would need careful study. Fisheries could change over in 10 years at little cost, but mining expects no return to offset conversion costs.

UNAFFECTED GROUPS

Several of the groups supplying inputs indicate that their sectors of the society are either only slightly concerned with measurements or do not use them at all. These include lawyers, bankers, accountants, credit bureaus, and securities dealers. Conversion—or even no conversion—would not affect these groups' activities.

II. GROUPS INVITED TO SUBMIT INPUTS

The following is an alphabetical list of associations, societies, unions, and other groups, together with their approximate memberships, that were invited to submit inputs to the U.S. Metric Study by the Department of Commerce.

Accrediting Commission for Business Schools
Membership unknown

Administrative Management Society
16,000 individuals

Adult Education Association of the U.S.A.
5,000 individuals

Aerospace Industries Association of America, Inc.
125 firms

Air Conditioning and Refrigeration Institute
200 firms

Aircraft Owners and Pilots Association
150,000 individuals

Air Freight Forwarders Association
24 firms

Air Line Dispatchers Association
800 individuals

Air Line Pilots Association
16,200 individuals

Airline Stewards and Stewardesses Association, International
7,000 individuals

Airport Operators Council, International
150 members

Air Transport Association of America
35 firms

Alabama Consumer Association
41 organizations
284 individuals

Alaska Consumer Council
50 individuals

Albuquerque Consumers Association
Membership unknown

Alexander Graham Bell Association for the Deaf
8,000 individuals

Alliance of Independent Telephone Unions
75,000 individuals

Allied Industrial Workers of America, International Union
83,000 individuals

Aluminum Association
80 firms

Aluminum Workers International Union
25,500 individuals

Amalgamated Clothing Workers of America
382,000 individuals

Amalgamated Meat Cutters and Butcher Workmen of North America
353,000 individuals

Amalgamated Transit Union
103,000 individuals

Amateur Athletic Union of the United States
100,000 individuals

American Academy of Actuaries
2,000 individuals

American Academy of Arts and Sciences
2,000 individuals

American Advertising Federation
35,000 individuals

American Agricultural Economics Association
4,500 individuals

American Apparel Manufacturers Association
800 firms

American Association for Health, Physical Education and Recreation
60,000 individuals

American Association for Textile Technology, Inc.
1,500 individuals

American Association for the Advancement of Science
130,000 individuals

American Association of Advertising Agencies
400 firms

American Association of Airport Executives
1,000 individuals

American Association of Botanical Gardens and Arboreta
325 institutions

American Association of Cost Engineers
2,100 individuals

American Association of Junior Colleges
800 institutions

American Association of Museums
4,500 institutions

American Association of Physics Teachers
14,000 individuals

American Association of Port Authorities
325 members

American Association of Retired Persons
2,000,000 individuals

American Association of School Administrators
18,000 individuals

American Association of School Librarians
9,000 individuals

American Association of State Highway Officials
53 states and territories

American Association of Textile Chemists and Colorists
10,000 individuals

American Association of University Professors
100,000 individuals

American Association of University Women
171,000 individuals

American Bakers Association
2,000 firms

American Bankers Association
19,000 firms

American Bar Association
140,000 individuals

American Boat Builders and Repairers Association
125 firms

American Brush Manufacturers Association
200 firms

American Bureau of Shipping
200 firms

American Business Press, Inc.
125 firms

American Business Women's Association
50,000 individuals

American Camping Association
7,500 individuals

American Cemetery Association
2,000 firms

American Ceramic Society
7,500 individuals

American Chemical Society
115,000 individuals

American College of Surgeons
29,000 individuals

American Concrete Institute
15,000 individuals

American Consumers Association, Inc.
300 individuals

American Council of Learned Societies
35 societies

American Council on Consumer Interests
2,300 individuals

American Council on Education
400 associations and societies
1,200 individuals

American Culinary Federation
1,000 individuals

American Dental Association
110,000 individuals

American Dental Trade Association
200 firms

American Die Casting Institute
125 firms

American Dietetic Association
21,000 individuals

American Dry Milk Institute, Inc.
200 firms

American Educational Research Association
10,000 individuals

American Farm Bureau Federation
1,700,000 individuals

American Federation of Government Employees
200,000 individuals

American Federation of Grain Millers
24,000 individuals

American Federation of Information Processing Societies
45,000 individuals

American Federation of Musicians
252,500 individuals

American Federation of State, County and Municipal Employees
281,300 individuals

American Federation of Teachers
125,000 individuals

American Federation of Technical Engineers
16,500 individuals

American Feed Manufacturers Association, Inc.
800 firms

American Fisheries Society
5,000 individuals

American Fishing Tackle Manufacturing Association
275 firms

American Flint Glass Workers Union
34,000 individuals

American Footwear Manufacturers Association
400 firms

American Forest Institute
600 firms

American Forestry Association
65,000 individuals

American Foundrymen's Society
15,000 individuals

American Frozen Food Institute
300 firms

American Gas Association
9,000 firms

American Gear Manufacturers Association
225 firms

American Geographical Society
4,500 individuals

American Geological Institute
20 societies with
35,000 individual members

American Geophysical Union
11,000 individuals

American Hardware Manufacturers Association
600 firms

American Historical Association
19,000 individuals

American Home Economics Association
50,000 individuals

American Home Lighting Institute
200 firms

American Hospital Association
9,000 institutions and
8,000 individuals

American Hotel and Motel Association
7,000 firms

American Industrial Arts Association
12,000 individuals

American Institute of Aeronautics and Astronautics
35,000 individuals

American Institute of Architects
24,000 individuals

American Institute of Baking
1,500 firms

American Institute of Biological Sciences
15,000 individuals

American Institute of Certified Public Accountants
70,000 individuals

American Institute of Chefs
1,200 individuals

American Institute of Chemical Engineers
40,000 individuals

American Institute of Consulting Engineers
450 individuals

American Institute of Food Distribution, Inc.
3,600 firms

American Institute of Industrial Engineers
21,000 individuals

American Institute of Interior Designers
5,000 individuals

American Institute of Laundering
4,500 firms

American Institute of Merchant Shipping
40 firms

American Institute of Mining, Metallurgical and Petroleum Engineers, Inc.
49,000 individuals

American Institute of Physics
40,000 individuals

American Institute of Planners
5,000 individuals

American Institute of Plant Engineers
5,000 individuals

American Institute of Real Estate Appraisers
3,500 individuals

American Institute of Steel Construction
350 firms

American Insurance Association
175 firms

American Iron and Steel Institute
3,000 firms

American Ladder Institute
50 firms

American Land Title Association
2,300 firms

American Leather Chemists Association
9,000 individuals

American Library Association
36,000 libraries and individuals

American Management Association
65,000 individuals

American Maritime Association
100 firms

American Marketing Association
16,000 individuals

American Mathematical Society
15,000 individuals

American Meat Institute
800 firms

American Medical Association
225,000 individuals

American Metal Stamping Association
500 firms

American Meteorological Society	9,000 individuals
American Mining Congress	600 firms
American Movers Conference	1,600 firms
American Mutual Insurance Alliance	125 firms
American National Cattlemen's Association	250,000 individuals
American National Standards Institute	900 firms 155 associations
American National Theatre and Academy	4,000 individuals
American Newspaper Guild	31,400 individuals
American Newspaper Publishers Association	1,000 firms
American Nurses' Association, Inc.	185,000 individuals
American Nursing Home Association	7,000 firms
American Occupational Therapy Association, Inc.	11,000 individuals
American Optometric Association, Inc.	15,000 individuals
American Ordnance Association	50,000 individuals
American Paper Institute	225 firms
American Petroleum Institute	9,000 firms
American Petroleum Refiners Association	30 firms
American Pharmaceutical Association	50,000 individuals
American Plywood Association	200 firms
American Public Health Association	21,000 individuals
American Public Power Association	1,300 utilities
American Public Works Association	12,000 individuals
American Radio Association	1,000 individuals
American Railway Car Institute	25 firms
American Railway Engineering Association	4,000 individuals
American Railway Supervisors Association	5,800 individuals
American Rental Association, Inc.	1,200 firms
American Retail Federation	75 associations representing 800,000 firms
American Road Builders Association	6,000 firms
American Short Line Railroad Association	250 firms
American Society for Engineering Education	13,000 individuals
American Society for Metals	45,000 individuals
American Society for Nondestructive Testing	6,000 individuals
American Society for Quality Control, Inc.	23,000 individuals
American Society for Testing and Materials	16,000 individuals
American Society of Agricultural Engineers	7,000 individuals
American Society of Appraisers	3,000 individuals
American Society of Association Executives	3,100 individuals
American Society of Bakery Engineers	3,600 individuals

American Society of Brewing Chemists
900 individuals

American Society of Civil Engineers
65,000 individuals

American Society of Heating Refrigerating and Air Conditioning Engineers
25,000 individuals

American Society of Landscape Architects, Inc.
3,000 individuals

American Society of Mechanical Engineers, Inc.
65,000 individuals

American Society of Microbiology
10,000 individuals

American Society of Planning Officials
6,000 individuals

American Society of Professional Biologists
260 individuals

American Society of Sanitary Engineering
3,000 individuals

American Spice Trade Association
250 firms

American Stock Yards Association
40 firms

American Subcontractors Association
30 firms

American Textile Machinery Association
125 firms

American Textile Manufacturers Institute
600 firms

American Train Dispatchers Association
3,800 individuals

American Transit Association
500 firms

American Trucking Association, Inc.
51 firms

American Veterinary Medical Association
20,000 individuals

American Vocational Association
50,000 individuals

American Warehousemen's Association
500 firms

American Watchmakers Institute
4,000 individuals

American Watch Workers Union
2,000 individuals

American Waterways Operators, Inc.
300 firms

American Water Works Association
21,000 individuals

American Welding Society
22,000 individuals

American Yarn Spinners Association, Inc.
100 firms

Anti-Friction Bearing Manufacturers Association, Inc.
50 firms

Apartment Association of America
700 firms

Arizona Consumers Council
1,000 individuals

Asphalt Institute
70 firms

Associated Actors and Artistes of America
62,000 individuals

Associated Builders and Contractors, Inc.
3,000 firms

Associated Credit Bureaus, Inc.
4,000 firms

Associated General Contractors of America
9,500 firms

Associated Master Barbers and Beauticians of America
11,000 individuals

Associated Tobacco Manufacturers, Inc.
20 firms

Associated Unions of America
4,000 individuals

Association for Childhood Education International
60,000 individuals

Association for Computing Machinery
27,000 individuals

Association for Educational Communications and Technology
10,000 individuals

Association for Supervision and Curriculum Development
13,000 individuals

Association of American Colleges
900 colleges

Association of American Geographers
6,000 individuals

Association of American Law Schools
125 colleges

Association of American Medical Colleges
3,500 colleges

Association of American Publishers
200 firms

Association of American Railroads
275 firms

Association of American Universities
50 universities

Association of California Consumers
Membership unknown

Association of Classroom Teachers
900,000 individuals

Association of College and Research Libraries
12,000 libraries

Association of Collegiate Schools of Architecture
400 colleges

Association of Electronic Manufacturers, Inc.
250 firms

Association of Engineers and Scientists
70 individuals

Association of Graduate Schools in Association of American Universities
50 colleges

Association of Home Appliance Manufacturers
100 firms

Association of Manufacturers of Confectionery and Chocolate, Inc.
125 firms

Association of Massachusetts Consumers, Inc.
200 individuals

Association of Motion Picture and TV Producers
70 individuals

Association of Mutual Insurance Engineers
700 individuals

Association of Oil Pipe Lines
100 firms

Association of Pomona Valley Consumers
400 individuals

Association of State Colleges and Universities
200 colleges

Association of Stock Exchange Firms
600 firms

Association of Western Pulp and Paper Workers
23,000 individuals

Athletic Goods Manufacturers Association
70 firms

Auto Body Association of America
3,000 firms

Automobile Manufacturers Association, Inc.
10 firms

Automotive Parts Rebuilders Association
600 firms

Automotive Service Industry Association
5,000 firms

Bakery and Confectionery Workers International Union of America
61,000 individuals

Barbers, Hairdressers and Cosmetologists' International Union of America, The Journeymen
72,000 individuals

Barre Granite Association, Inc.
40 firms

Bicycle Institute of America
250 firms

Biscuit and Cracker Manufacturers Association
250 firms

Bismarck-Mandan Consumers League
Membership unknown

B'nai B'rith Women
135,000 individuals

Book Manufacturers Institute
125 firms

Boot and Shoe Workers' Union
40,000 individuals

Boys' and Young Mens' Apparel Manufacturers Association
700 firms

Brewing Industries Research Institute
Membership unknown

Bricklayers, Masons and Plasterers International Union of America
149,000 individuals

Brotherhood of Locomotive Engineers
39,600 individuals

Brotherhood of Maintenance of Way Employees
141,000 individuals

Brotherhood of Railroad Signalmen of America
12,200 individuals

Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees
270,000 individuals

Brotherhood of Railway Carmen of the United States and Canada
125,600 individuals

Brotherhood of Shoe and Allied Craftsmen
2,700 individuals

Brotherhood of Sleeping Car Porters
6,000 individuals

Brotherhood of Utility Workers of New England, Inc.
3,900 individuals

Building Officials and Code Administrators International of America
1,300 individuals

Building Owners and Managers Association International
3,000 individuals

Building Research Advisory Board
700 individuals

Business Equipment Manufacturers Association
70 firms

California Redwood Association
10 firms

Can Manufacturers Institute, Inc.
55 firms

Canvas Products Association International
500 firms

Car and Truck Renting and Leasing Association
1,100 firms

Carpet and Rug Institute
400 firms

Casket Manufacturers Association of America
300 firms

Chefs De Cuisine Association of America
400 individuals

Chemical Specialties Manufacturers Association, Inc.
550 firms

Chocolate Manufacturers Association of the U.S.A.
20 firms

Christian Labor Association of the United States of America
Membership unknown

Cigar Institute of America
800 firms

Cigar Makers' International Union of America
3,600 individuals

Cigar Manufacturers Association of America, Inc.
55 firms

Citizens for Consumer Action
Membership unknown

Clothing Manufacturers Association of U.S.A.
70 firms

Colorado Consumers Association, Inc.
Membership unknown

Colorado Housewives Encouraging Consumer Knowledge (CHECK)
Membership unknown

Commerce and Industry Association of New York
3,500 firms

Communications Workers of America
321,000 individuals

Compressed Air and Gas Institute
40 firms

Concrete Pipe Association, Inc.
2 associations representing
250 firms

Conference Board of the Mathematical Sciences
10 associations

Congress of Independent Unions
2,500 members

Connecticut Consumer Association, Inc.
90 individuals

Construction Specifications Institute
11,000 individuals

Consulting Engineers Council of the U.S.A.
2,300 individuals

Consumer Assembly of Greater New York
107 organizations

Consumer Association of the District of Columbia
275 individuals

Consumer Association of Indiana, Inc.
10 organizations
25 individuals

Consumer Association of Kentucky, Inc.
Membership unknown

Consumer Association of West Virginia
200 individuals
8 groups

Consumer Conference of Greater Cincinnati
1,000 individuals

Consumer Federation of America
175 associations

Consumer Research Advisory Council
150 individuals

Consumers League of New Jersey
Membership unknown

Consumers League of Ohio
300 individuals

Consumers Union of U.S., Inc.
1,900,000 individuals

Cooperative League of the U.S.A.
20,000 individuals

Coopers International Union of North America
2,600 individuals

Copper Development Association, Inc.
80 firms

Copper Institute
25 firms

Cordage Institute
50 firms

Corrugated Container Institute
10 firms

Corset and Brassiere Association of America
65 firms

Council for Exceptional Children
18,000 individuals

Council for Professional Education for Business
15 associations

Council of Graduate Schools in the United States
300 colleges

Council of Hotel, Restaurant, and Institutional Education
125 colleges
225 individuals
50 firms

Council of Housing Producers
Membership unknown

Council of Mechanical Specialty Contracting Industries, Inc.
4 associations

Council of National Organizations for Adult Education
55 associations

Council of State Governments
50 states

Credit Union National Association, Inc.
24,000 credit unions

Cutting Tool Manufacturers Association
175 firms

Dade County Consumers Council
Membership unknown

Data Processing Management Association
28,000 individuals

D.C. Citywide Consumer Council
200 individuals

Directors Guild of America, Inc.
3,200 individuals

Distillery, Rectifying, Wine and Allied Workers' International Union of America
40,000 individuals

Drug, Chemical, and Allied Trades Association, Inc.
800 firms

Edison Electric Institute
225 firms

Elastic Fabric Manufacturers Institute, Inc.
40 firms

Electrical Apparatus Service Association
1,800 firms

Electric Heating Association, Inc.
200 firms

Electronic Industries Association
325 firms

Engineers Council for Professional Development
30 societies

Envelope Manufacturers Association
175 firms

Evaporated Milk Association
25 firms

Farm and Industrial Equipment Institute
400 firms

Farm Equipment Manufacturers Association
400 firms

Farmers Educational and Cooperative Union of America
250,000 families

Federal Employees Association
219 individuals

Federal Plant Quarantine Inspectors National Association
300 individuals

Federated Council of the International Association of Railway Employees and Association of Railway Trainmen and Locomotive Firemen
300 individuals

Federation of Homemakers
2,500 individuals

Financial Analysts Federation
13,000 individuals

Fire Equipment Manufacturers Association
15 firms

Flavor and Extracts Manufacturers Association of U.S.
300 firms

Flight Engineers' International Association
2,700 individuals

Florida Consumers Association, Inc.
100 individuals

Fluid Power Society
5,000 individuals

Food Processing Machinery and Supplies Association
300 firms

Food Tray and Board Association, Inc.
15 firms

Forest Products Research Society
5,000 individuals

Forging Industry Association
150 firms

Freight Forwarders Institute
20 firms

Gas Appliance Manufacturers Association
700 firms

Gasoline Pump Manufacturers Association
10 firms

General Federation of Women's Clubs, Inc.
15,000 clubs

Geological Society of America, Inc.
8,000 individuals

Georgia Consumer Council
40 individuals

Glass Bottle Blowers' Association of the United States and Canada
68,000 individuals

Glass Container Manufacturers Institute
70 firms

Grain and Feed Dealers National Association
1,900 firms

Granite Cutters International Association of America
2,900 individuals

Graphic Arts Technical Foundation
2,500 individuals

Great Lakes Licensed Officers' Organization
117 individuals

Grocery Manufacturers of America
225 firms

Gypsum Drywall Contractors International
700 firms

Hard Fibers Association
15 firms

Health Insurance Association of America
350 firms

Health Insurance Institute
325 firms

Home Economics Education Association (NEA)
2,200 individuals

Hotel and Restaurant Employees' and Bartenders' International Union
450,000 individuals

Human Factors Society, Inc.
1,600 individuals

Illinois Federation of Consumers
Membership unknown

Illuminating Engineering Society
11,000 individuals

Independent Bankers Association of America
7,000 firms

Independent Garage Owners of America
5,000 firms

Independent Natural Gas Association of America
2,700 firms

Independent Petroleum Association of America
11,000 firms

Independent Watchmen's Association
10,000 individuals

Industrial Fasteners Institute
70 firms

Industrial Forestry Association
85 firms

Industrial Heating Equipment Association
55 firms

Industrial Union of Marine and Shipbuilding Workers of America
43,000 individuals

Institute for Rapid Transit
100 firms

Institute of Boiler and Radiator Manufacturers
80 firms

Institute of Electrical and Electronics Engineers, Inc., The
170,000 individuals

Institute of Food Technologists
10,000 individuals

Institute of Paper Chemistry
116 firms

Institute of Scrap Iron and Steel
1,400 firms

Institute of Traffic Engineers
3,500 individuals

Institutional Foodservice Manufacturers Association
125 firms

Instrument Society of America
21,000 individuals

Insurance Rating Board
150 firms

Insurance Workers International Union
22,000 individuals

International Alliance of Bill Posters, Billers and Distributors of the United States and Canada
1,600 individuals

International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada
62,200 individuals

International Association of Assessing Officers
6,000 individuals

International Association of Bridge and Structural Iron Workers
162,000 individuals

International Association of Chiefs of Police, Inc.
6,000 individuals

International Association of Fire Chiefs
8,000 individuals

International Association of Fire Fighters
115,000 individuals

International Association of Heat and Frost Insulators and Asbestos Workers
12,500 individuals

International Association of Ice Cream Manufacturers
900 firms

International Association of Machinists and Aerospace Workers
836,200 individuals

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers and Terrazzo Helpers
8,700 individuals

International Association of Siderographers
29 individuals

International Association of Tool Craftsmen
500 individuals

International Association of Visual Communications Management, Inc.
5,000 individuals

International Association of Wall and Ceiling Contractors
450 firms

International Bridge, Tunnel and Turnpike Association, Inc.
170 firms

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers
140,000 individuals

International Brotherhood of Bookbinders
61,800 individuals

International Brotherhood of Electrical Workers
875,000 individuals

International Brotherhood of Firemen and Oilers
45,000 individuals

International Brotherhood of Operative Potters
16,350 individuals

International Brotherhood of Painters and Allied Trades of the United States and Canada
200,600 individuals

International Brotherhood of Pulp, Sulphite and Paper Mill Workers of the United States and Canada
171,200 individuals

International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America
1,700,300 individuals

International City Management Association
5,000 individuals

International Conference of Building Officials
1,000 individuals

International Die Sinkers' Conference
3,500 individuals

International Guards Union of America
2,100 individuals

International Jewelry Workers Union
14,200 individuals

International Ladies' Garment Workers Union
455,200 individuals

International Leather Goods, Plastics and Novelty Workers Union
38,000 individuals

International Longshoremen's and Warehousemen's Union
60,000 individuals

International Longshoremen's Association
80,000 individuals

International Mailers Union
4,200 individuals

International Maintenance Institute
1,000 individuals

International Molders and Allied Workers Union, AFL-CIO
80,000 individuals

International Organization of Masters, Mates, and Pilots
9,000 individuals

International Plate Printers, Die Stampers and Engravers Union of North America
400 individuals

International Printing Pressmen's and Assistants' Union of North America
114,000 individuals

International Stereotypers and Electrotypers Union of North America
11,100 individuals

International Taxicab Association
1,000 firms

International Typographical Union
106,700 individuals

International Union Guard Workers of America, United Plant
12,000 individuals

International Union of Dolls, Toys, Playthings, Novelties and Allied Products of the United States and Canada
25,000 individuals

International Union of Electrical, Radio and Machine Workers
320,000 individuals

International Union of Elevator Constructors
14,500 individuals

International Union of Journeymen, Horse Shoers of United States and Canada
300 individuals

International Union of Life Insurance Agents
2,000 individuals

International Union of Operating Engineers
330,000 individuals

International Union of United Brewery, Flour, Cereal, Soft Drink and Distillery Workers
55,000 individuals

International Union of Wood, Wire and Metal Lathers
15,500 individuals

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America
1,402,700 individuals

International Woodworkers of America
94,200 individuals

Investment Company Institute
275 firms

Jewelry Manufacturers Association
125 firms

Joint Council of Economic Education
31,000 individuals

Laborers' International Union of North America
474,600 individuals

Laundry and Dry Cleaning International Union
23,400 individuals

Lead Industries Association, Inc.
65 firms

League of Utah Consumers
Membership unknown

League of Women Voters of the United States
150,000 individuals

Leather Industries of America
400 firms

Leather Workers International Union of America
5,500 individuals

Life Insurance Association of America
125 firms

Linen Supply Association of America
1,500 firms

Lithographers and Photoengravers International Union
53.000 individuals

Louisiana Consumer League
450 individuals

Luggage and Leather Goods Manufacturers of America. Inc.
200 firms

Machine Printers and Engravers Association of the United States
1.300 individuals

Machinery and Allied Products Institute
25 associations

Magazine Publishers Association. Inc.
125 firms

Mail Order Association of America
15 firms

Major League Baseball Players Association
700 individuals

Manufacturing Chemists' Association
200 firms

Manufacturing Jewelers and Silversmiths of America. Inc.
850 firms

Marine Engineers Beneficial Association
11.000 individuals

Maryland Consumers Association. Inc.
11 organizations
100 individuals

Mason Contractors Association of America
2.000 firms

Material Handling Institute. Inc.
325 firms

Mathematical Association of America
19.000 individuals

Mechanical Contractors Association of America. Inc.
1.300 firms

Mechanics Educational Society of America
37.000 individuals

Medical Surgical Manufacturers Association
100 firms

Metal Polishers. Buffers. Platers and Helpers International Union
10.000 individuals

Metric Association. Inc.
1.500 individuals

Metropolitan New York Consumer Council
Membership unknown

Minnesota Consumers League
Membership unknown

Missouri Association of Consumers
200 individuals

Mobile Homes Manufacturers Association
350 firms

Motel Association of America
6,500 firms

Motion Picture Association of America
25 firms

Motor and Equipment Manufacturers Association
600 firms

Municipal Finance Officers Association
4,500 individuals

Mutual Insurance Advisory Association
150 firms

Narrow Fabrics Institute
30 firms

National Academy of Engineering
375 individuals

National Academy of Sciences
950 individuals

National Aerospace Education Council
4,000 individuals

National Agriculture Chemists Association
150 individuals

National Alliance of Postal and Federal Employees
37,000 individuals

National Alliance of Television and Electronic Service Association
8,000 firms

National–American Wholesale Grocers Association
400 firms

National Appliance and Radio-TV Dealers Association
5,500 firms

National Appliance Service Association
125 firms

National Association for Community Development
5,000 individuals

National Association for Public Continuing and Adult Education
6,000 individuals

National Association for the Advancement of Colored People
500,000 individuals

National Association of Accountants
70,000 individuals

National Association of ASCS County Office Employees
14,300 individuals

National Association of Bedding Manufacturers
725 firms

National Association of Biology Teachers
8,000 individuals

National Association of Broadcast Employees and Technicians
5,500 individuals

National Association of Broadcasters
4,000 firms

National Association of Building Manufacturers
200 firms

National Association of Casualty and Surety Executives
70 individuals

National Association of Chain Drug Stores
600 firms

National Association of Chain Manufacturers
15 firms

National Association of Colleges and Teachers of Agriculture
1,600 individuals

National Association of Colored Women's Clubs
100,000 individuals

National Association of Counties
20,000 counties

National Association of County Agricultural Agents
6,000 individuals

National Association of Credit Management
40,000 individuals

National Association of Electric Companies
150 firms

National Association of Elementary School Principals
26,000 individuals

National Association of Engineering Companies
50 firms

National Association of Extension Home Economists
3,700 firms

National Association of Federal Veterinarians
1,400 individuals

National Association of Food Chains
250 firms

National Association of Furniture Manufacturers
500 firms

National Association of Glove Manufacturers, Inc.
100 firms

National Association of Government Employees
200,000 individuals

National Association of Government Inspectors
1,200 individuals

National Association of Greeting Card Publishers
100 firms

National Association of Home Builders
51,000 firms

National Association of Hosiery Manufacturers
500 firms

National Association of Housing and Redevelopment Officials
12,000 individuals

National Association of Independent Food Retailers
12,000 firms

National Association of Independent Schools
800 schools

National Association of Letter Carriers
190,000 individuals

National Association of Life Underwriters
100,000 individuals

National Association of Manufacturers
15,000 firms

National Association of Margarine Manufacturers
20 firms

National Association of Mens' and Boys' Apparel Clubs
7,000 individuals

National Association of Motor Bus Owners
600 firms

National Association of Mutual Insurance Companies
1,100 firms

National Association of Mutual Savings Banks
525 firms

National Association of Negro Business and Professional Women's Clubs, Inc.
7,000 individuals

National Association of Photographic Manufacturers
100 firms

National Association of Planners-Estimators, and Progressmen
2,000 individuals

National Association of Plumbing-Heating-Cooling Contractors
9,000 firms

National Association of Postal Supervisors
31,700 individuals

National Association of Postmasters of the U.S.
31,000 individuals

National Association of Post Office and General Services Maintenance Employees
9,300 individuals

National Association of Power Engineers, Inc.
13,000 individuals

National Association of Purchasing Agents
19,000 individuals

National Association of Real Estate Boards
90,000 individuals

National Association of Refrigerated Warehouses
525 firms

National Association of Retail Druggists
36,000 firms

National Association of Retail Grocers of the U.S.
50,000 firms

National Association of Secondary School Principals
32,000 individuals

National Association of Securities Dealers, Inc.
4,000 firms

National Association of Service Managers
350 individuals

National Association of Small Business Investment Companies
250 firms

National Association of Special Delivery Messengers
2,100 firms

National Association of State Universities and Land Grant Colleges
100 colleges

National Association of Textile and Apparel Wholesalers
300 firms

National Association of Theatre Owners
12,000 firms

National Association of Trade and Technical Schools
300 schools

National Association of Variety Stores
650 firms

National Association of Wheat Growers
80,000 individuals

National Association of Wholesaler-Distributors
21,000 firms

National Association of Wool Manufacturers
150 firms

National Automatic Merchandising Association
1,900 firms

National Automobile Dealers Association
22,000 firms

National Band Association
1,600 individuals

National Bankers Association
25 firms

National Bar Association
4,000 individuals

National Brotherhood of Packinghouse and Dairy Workers
50,000 individuals

National Building Material Distributors Association
375 firms

National Business Education Association
12,000 individuals

National Canners Association
600 firms

National Coal Association
150 firms

National Coffee Association of the U.S.A.
325 firms

National Collegiate Athletic Association
700 colleges

National Commission on Accrediting
1,300 colleges

National Concrete Masonry Association
600 firms

National Confectioners Association of the United States, Inc.
600 firms

National Conference of Standards Laboratories
250 laboratories

National Conference of States on Building Codes and Standards
55 delegates

National Congress of Parents and Teachers
12,000,000 individuals

National Constructors Association
35 firms

National Consumer Finance Association
15,000 firms

National Consumers League
16,000 individuals

National Cotton Council of America
300 firms

National Council for Geographic Education
8,000 individuals

National Council for the Social Studies
18,000 individuals

National Council of Catholic Men
8,400 groups

National Council of Catholic Women
10,000,000 individuals

National Council of Farmer Cooperatives
130 firms

National Council of Jewish Women
125,000 individuals

National Council of Negro Women
3,850,000 individuals

National Council of Senior Citizens
2,000 associations representing
2,000,000 individuals

National Council of Teachers of English
50,000 individuals

National Council of Teachers of Mathematics
80,000 individuals

National Council of the Churches of Christ in the U.S.A.
30 demoninations with
145,000 churches

National Council of the Young Men's Christian Associations of the United States of America
4,500,000 individuals

National Crushed Stone Association
375 firms

National Customs Brokers and Forwarders Association of America
650 firms

National Dental Association
700 individuals

National Education Association of the U.S.
1,100,000 individuals

National Education Association Division of Adult Education Service
No separate membership from NEA

National Electrical Contractors Association, Inc.
5,500 firms

National Electrical Manufacturers Association
500 firms

National Elevator Industry, Inc.
55 firms

National Environmental Systems Contractors Association
2,500 firms

National Executive Housekeepers Association
4,000 individuals

National Farm and Power Equipment Dealers Association
13,000 firms

National Farmers Union
250,000 families

National Federation of Federal Employees
80,000 individuals

National Federation of Grain Cooperatives
25 firms

National Federation of Independent Business
270,000 individuals

National Federation of Licensed Practical Nurses
31,000 individuals

National Federation of Post Office Motor Vehicle Employees
8,200 individuals

National Federation of Settlements and Neighborhood Centers
400 centers

National Fluid Power Association
150 firms

National Fire Protection Association
25,000 individuals

National Fisheries Institute
500 firms

National Flexible Packaging Association
175 firms

National Forest Products Association
20 associations with
1,500 firms

National Foundry Association
350 firms

National Furniture Warehousemen's Association
1,300 firms

National Governors Conference
50 governors

National Grange
800,000 individuals

National Hairdressers and Cosmetologists Association, Inc.
70,000 individuals

National Hand Knitting Yarn Association
50 firms

National Higher Education Association
28,000 individuals

National Home Furnishing Association
9,000 firms

National Home Study Council
150 schools

National Housewares Manufacturers Association
900 firms

National Housewives' League of America, Inc.
30,000 individuals

National Independent Automobile Dealers Association
2,500 firms

National Independent Dairies Association
325 firms

National Industrial Traffic League
1,700 individuals

National Industrial Workers Union
Membership unknown

National Industries for the Blind
70 agencies

National Institute of Diaper Services, Inc.
70 firms

National Institute of Drycleaning
10,000 firms

National Institute of Governmental Purchasing, Inc.
700 firms

National Institute of Municipal Law Officers
1,500 individuals

National Institute of Packaging, Handling and Logistic Engineers
400 individuals

National Institute of Real Estate Brokers
18,000 individuals

National Institute of Rug Cleaning, Inc.
600 firms

National Knitted Outerwear Association
900 firms

National Knitwear Manufacturers Association
900 firms

National League of Cities
15,000 cities

National League of Postmasters of the U.S.
18,000 individuals

National Licensed Beverage Association
45,000 firms

National Lime Association
60 firms

National Limestone Association
700 firms

National Liquor Stores Association
40,000 firms

National LP-Gas Association
3,600 firms

National Lumber and Building Material Dealers Association
30 associations

National Macaroni Manufacturers Association
100 firms

National Machine Tool Builders' Association
200 firms

National Management Association
95,000 individuals

National Marine Engineers' Beneficial Association
11,000 individuals

National Maritime Union of America
45,000 individuals

National Medical Association
6,000 individuals

National Milk Producers Federation
125 firms

National Newspaper Association
7,000 firms

National Notion Association
160 firms

National Oil Fuel Institute
8,000 firms

National Outerwear and Sportswear Association, Inc.
150 firms

National Paint, Varnish and Lacquer Association
1,200 firms

National Paper Box Association
400 firms

National Pest Control Association, Inc.
1,300 firms

National Petroleum Refiners Association
125 firms

National Postal Union
70,000 individuals

National Ready Mixed Concrete Association
1.100 firms

National Restaurant Association
15.000 firms

National Retail Hardware Association
24.000 firms

National Retail Merchants Association
16.000 firms

National Rural Electric Cooperative Association
1.000 firms

National Rural Letter Carriers' Association
40.400 individuals

National Sand and Gravel Association
600 individuals

National Scale Men's Association
1.200 individuals

National School Boards Association
52 boards

National Science Teachers Association
25,000 individuals

National Screw Machine Products Association
300 firms

National Secretaries Association
27.000 individuals

National Security Industrial Association
450 firms

National Shoe Retailers Association
6.000 firms

National Small Business Association
36.000 firms

National Society of Professional Engineers
70.000 individuals

National Soft Drink Association
2.500 firms

National Sporting Goods Association
4.000 firms

National Tool. Die. and Precision Machinery Association
1.500 firms

National University Extension Association
175 colleges

National Urban League
50.000 individuals

National Vocational Agricultural Teachers Association
10.000 individuals

National Warm Air Heating and Air Conditioning Association
2.500 firms

National Waterways Conference. Inc.
550 firms

National Wholesale Druggists Association
900 firms

National Wooden Pallet and Container Association
235 firms

Negro College Committee on Adult Education
10 individuals

Newspaper and Mail Deliverers' Union of New York and Vicinity
3.500 individuals

North Carolina Consumers Council
2.000 individuals
23 organizations

Northern Textile Association
300 firms

Office and Professional Employees International Union
70.000 individuals

Ohio Consumers Association
17 organizations
91 individuals

Oil. Chemical and Atomic Workers International Union
165.400 individuals

Operations Research Society of America
7.000 individuals

Operative Plasterers' and Cement Masons' International Association of the United States and Canada
68.000 individuals

Optical Manufacturers Association
70 firms

Order of Railway Conductors and Brakemen
18,800 individuals

Oregon Consumers League
500 individuals

Packaging Institute, Inc.
1,600 individuals

Packaging Machinery Manufacturers Institute
125 firms

Paper Bag Institute, Inc.
20 firms

Paper Shipping Sack Manufacturers Association
30 firms

Paper Stationery and Tablet Manufacturers Association
55 firms

Patent Office Professional Association
600 individuals

Pattern Makers League of North America
13,400 individuals

Peninsula Consumer League, Inc.
Membership unknown

Pennsylvania League for Consumer Protection
90 organizations
500 individuals

Pharmaceutical Manufacturers Association
150 firms

Pickle Packers International, Inc.
175 firms

Plastic Products Manufacturers Association, Inc.
125 firms

Plate, Cup, and Container Institute, Inc.
25 firms

Portland Cement Association
70 firms

Poultry Breeders of America
32 firms

Printing Industries of America
8,000 firms

Private Truck Council of America, Inc.
1,600 firms

Producers' Council, Inc.
225 firms

Professional Photographers of America
11,000 individuals

Radio-Television News Directors Association
1,100 individuals

Railroad Yardmasters of America
2,000 individuals

Railroad Yardmasters of North America, Inc.
2,000 individuals

Retail Clerks International Association
500,400 individuals

Retail, Wholesale and Department Store Union
170,500 individuals

Rhode Island Consumers' League
Membership unknown

Rubber Manufacturers Association
185 firms

St. Louis Consumer Federation
25 organizations
50 individuals

Sales and Marketing Executives – International
28,000 individuals

Salt Institute
30 firms

Scale Manufacturers Association
40 firms

Schiffli Lace and Embroidery Manufacturers Association
500 firms

Scientific Apparatus Makers Association
250 firms

Screen Manufacturers Association
30 firms

Seafarers International Union of North America
80,300 individuals

Service Employees International Union, AFL-CIO
420,000 individuals

Sewing Machine Trade Association
30 firms

Sheet Metal and Air Conditioning Contractors' National Association, Inc.
2,300 firms

Sheet Metal Workers International Association
100,000 individuals

Shipbuilders Council of America
50 firms

Soap and Detergent Association
150 firms

Society for Advancement of Management, Inc.
13,000 individuals

Society for Experimental Stress Analysis
3,000 individuals

Society for Industrial and Applied Mathematics
4,000 individuals

Society of Aerospace Material and Process Engineers
2,500 individuals

Society of American Florists
5,500 firms

Society of American Foresters
20,000 individuals

Society of American Military Engineers
26,000 individuals

Society of Applied Medical Systems
Membership unknown

Society of Automotive Engineers, Inc.
27,000 individuals

Society of Fire Protection Engineers
1,500 individuals

Society of Manufacturing Engineers
50,000 individuals

Society of Motion Picture and Television Engineers, Inc.
8,000 individuals

Society of Naval Architects and Marine Engineers
10,000 individuals

Society of Packaging and Handling Engineers
2,000 individuals

Society of Photographic Scientists and Engineers
3,600 individuals

Society of Plastics Engineers, Inc.
15,000 individuals

Society of Real Estate Appraisers
18,000 individuals

Society of Soft Drink Technologists
600 individuals

Society of the Plastics Industry, Inc.
1,500 firms

Society of Women Engineers
1,200 individuals

Society of Wood Science and Technology
600 individuals

South Dakota Consumers League
Membership unknown

Southern Building Code Conference
614 towns, counties and cities

Southern Furniture Manufacturers Association
300 firms

Southern Labor Union
2,500 individuals

Sporting Arms and Ammunition Manufacturers Institute
10 firms

Steel Founder's Society of America
140 firms

Stove, Furnace and Allied Appliance Workers' of North America
9,000 individuals

Structural Clay Products Institute
125 firms

Sulphur Institute
40 firms

Super Market Institute
400 firms

Surety Association of America
60 firms

Tanners Council of America
375 firms

Technical Association of the Pulp and Paper Industry
14,000 individuals

Telephone Group of ANSI
1,300 firms

Theater Equipment and Supply Manufacturers Association
60 firms

Texas Consumers Association
Membership unknown

Textile Distributors Association, Inc.
200 firms

Textile Foremen's Guild, Inc.
215 individuals

Textile Workers Union of America
182,000 individuals

Tobacco Associates, Inc.
400,000 individuals

Tobacco Institute
15 firms

Tobacco Workers International Union
32,500 individuals

Toilet Goods Association, Inc.
550 firms

Tool and Die Institute
900 firms

Toy Manufacturers of America
350 firms

Transport Workers Union of America
135,000 individuals

Tricot Institute of America, Inc.
50 firms

Truck Body and Equipment Association, Inc.
700 firms

United Allied Workers International Union
600 individuals

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada
284,800 individuals

United Brick and Clay Workers of America
21,000 individuals

United Brotherhood of Carpenters and Joiners of America
800,000 individuals

United Business Schools Association
500 schools

United Cement, Lime and Gypsum Workers International Union
35,600 individuals

United Church Women of the National Council of Churches
10,000,000 individuals

United Electrical, Radio and Machine Workers of America
320,000 individuals

United Federation of Postal Clerks
143,200 individuals

United Fresh Fruit and Vegetable Association
2,800 firms

United Furniture Workers of America
37,500 individuals

United Garment Workers of America
27,000 individuals

United Glass and Ceramic Workers of North America
48,300 individuals

United Hatters, Cap and Millinery Workers International Union
30,000 individuals

United International Union of Welders
2,000 individuals

United Mine Workers of America
232,000 individuals

United Papermakers and Paperworkers
144,300 individuals

United Rubber, Cork, Linoleum and Plastic Workers of America
170,500 individuals

United Shoe Workers of America
53,000 individuals

United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association
22,900 individuals

United States Beet Sugar Association
10 firms

U.S. Brewers Association, Inc.
400 firms

U.S. Conference of Mayors
500 individuals

United States Independent Telephone Association
1,300 firms

United States Savings and Loan League
5,200 firms

U.S. Screw Service Bureau, representing
  Aerospace Precision Fastener Association
  Aircraft Locknut Manufacturers Association
  Precision Aerospace Rivet Association
  Sockets Group Products Bureau
  Tapping Screw Service Bureau
  Tubular and Split Rivet Council
  U.S. Cap. Screw and Special Threaded Products Bureau
  U.S. Machine Screw Service Bureau
  U.S. Wood Service Bureau
Members – 80 firms total

United Steelworkers of America
1,068,000 individuals

United Stone and Allied Products Workers of America
12,100 individuals

United Telegraph Workers
28,300 individuals

United Textile Workers of America
47,100 individuals

United Transportation Union
260,000 individuals

United Transport Service Employees of America
3,000 individuals

University Photographers Association of America
275 individuals

Upholstered Furniture Manufacturers Association
50 firms

Upholsterers' International Union of North America
58,300 individuals

Utility Workers Union of America
72,400 individuals

Valve Manufacturers Association
35 firms

Vinyl Fabrics Institute
25 firms

Virginia Citizens Consumer Council
150,000 individuals

Washington Committee on Consumer Interests
200 individuals

Washington Society of Engineers
600 individuals

Water Pollution Control Federation
16,000 individuals

Window Glass Cutters League of America
1,200 individuals

Wire Association, Inc.
3,000 firms

Wisconsin Consumers League
150 individuals
25 organizations

Woodworking Machinery Manufacturers Association
75 firms

Work Glove Manufacturers Association, Inc.
40 firms

Writers Guild of America, Inc.
1,400 individuals

Writing Instrument Manufacturers Association, Inc.
100 firms

Young Women's Christian Association of the U.S.A.
2,230,000 individuals

Zinc Institute, Inc.
150 firms

Zirconium Association
15 firms

III. INTRODUCTION

BACKGROUND OF THE U.S. METRIC STUDY

The metric system of measurement was developed in France in 1790, and, in a world that generally had no uniformity of its weights and measures, received much interest and attention. In the years that have followed, it has been adopted by an ever growing number of countries. The number of adherents has increased until at this time the United States is the only industrial country of any size not using or having announced its intention of using the metric system.

The use of the metric system in the United States was made legal with the passage of a bill by Congress in 1866. Many unsuccessful attempts followed to legislate a nationwide conversion. Recent developments, including metrication plans and activity in the other English-speaking countries of the world, caused Congress, in 1968, to enact the Metric Study Act (PL 90-472) authorizing the Secretary of Commerce to ". . . conduct a program of investigation, research, and survey to determine the impact of increasing worldwide use of the metric system on the United States; to appraise the desirability and practicability of increasing the use of metric weights and measures in the United States . . ." (see app. 1 for the complete text).

To carry out the directives of this Act, the Secretary of Commerce named the National Bureau of Standards, which brought together the U.S. Metric Study Group for these purposes. The Study Group conducted an extensive series of investigations and surveys aimed at answering the following key questions for all sectors and segments of the society:

> What is the present impact within the United States of increasing worldwide use of the metric system?

What would this impact be in the future, assuming that the use or nonuse of the metric system continues as at present, with no coordination among the various sectors of the society?

Alternatively, what would be the effect of a coordinated national program to increase the use of the metric system?

INPUTS FROM NATIONALLY REPRESENTATIVE GROUPS

To supplement the individual surveys and investigations, trade associations, professional societies, unions, and other nationally representative groups were invited to present their opinions and viewpoints relating to the three key questions outlined above.

Detailed reports were submitted by over 230 such groups and all of the information contained therein has received careful consideration in the deliberations of the U.S. Metric Study. This report summarizes these inputs and presents brief summaries of all those received. For convenience these are grouped into seven categories and these appear in chapters IV through X of this report, with each chapter corresponding to a category as detailed below:

1. Labor
2. Consumer Affairs
3. Education
4. Construction
5. Engineering-Related Industry
6. Consumer-Related Industry
7. Natural Resources, Transportation, Health, Small Business, and Others

In addition to gathering information as to the opinions and viewpoints of representatives of all sectors of the society, these inputs were an important means of providing widespread participation in the Study. Section 2(5) of the Metric Study Act, states, in part, that the Study Group should ". . . permit appropriate participation by representatives of . . . industry, science, engineering and labor, and their associations . . . ."

HOW THE INPUTS WERE OBTAINED

Inputs were sought from groups representing every sector of the economy and were obtained in a number of ways. First, a large number of groups were invited by the Secretary of Commerce to participate in one of a series of National Metric Study Conferences to present their input verbally. Additional groups were invited to submit their input in writing to the U.S. Metric Study. Finally, an announcement was published in the Federal Register stating that any such group was invited to submit its viewpoints and opinions to the U.S. Metric Study Group.

The selection of groups to participate in the conferences was guided by the need to choose a list of groups that—with reasonable number—assured adequate coverage of all sectors of the economy. In many cases difficult choices were made in the selection of a single group to represent a given sector of the economy where two or more groups were equally representative. However, in order to make the conferences workable, limitations were deemed advisable. Valuable assistance was obtained from members of the Metric System Study Advisory Panel in the selection of groups in areas of their expertise.

To supplement the inputs received at the conferences, a second listing was developed and groups on this list were invited to supply written statements to the U.S. Metric Study. These reports have received equal consideration in the preparation of this report and the final U.S. Metric Study report as those reports received at the conferences.

To further supplement the information received from those invited to submit statements, a notice was published in the Federal Register on May 21, 1970, (see app. 5) that the U.S. Metric Study was interested in receiving inputs from any interested group.

In order to receive inputs in a meaningful and usable form, it was necessary to supply guidelines and pertinent background material to those invited. These guidelines, which were based upon the three key questions outlined above and greatly expanded, differed slightly for the various groups contacted. A general set of guidelines was used for most groups. Special guidelines were prepared for the consumer, education, and labor sectors (see app. 6).

DETAILS OF THE CONFERENCES

The seven conferences were held in the categories previously described (see app. 3 for detailed agenda for each conference). It should be noted that the meetings were not typical conferences. In fact, the term "hearing" more closely approximates the nature of the meetings, wherein the invitees or witnesses generally attend only that portion of the meeting of direct interest to them.

A secondary benefit of the conferences (the major one was providing opportunity for inputs and, of course, receiving the information contained therein) was that they were public meetings at which *any* interested person could attend, and, in fact, participate in the discussions. A series of press releases and individual contacts with the press were utilized to advertise the conferences, and with the exception of the first conference there were no fees charged for attending. In addition, brochures announcing both the entire series and details of each individual conference were mailed to many thousands of potentially interested parties.

At every conference but the first, there were review or discussion panels made up principally of members of the Metric System Study Advisory Panel (see app. 4 for the makeup of these panels). The review panel first listened to each presentation and then responded with questions of the presenter. When time permitted, the audience was then allowed to question the presenter.

There was extensive interaction with each of the groups invited to participate in the conferences to help them prepare their inputs. This interaction provided an opportunity to discuss the guidelines and explain the assumptions and provide whatever other assistance was needed.

IV. LABOR

A SUMMARY OF INPUTS

This conference was planned with the cooperation of the American Federation of Labor–Congress of Industrial Organizations to get the workers' viewpoint concerning increased metric usage. Unions were divided into nine broad groups for purposes of presentations at the conference. A spokesman for each area was selected by AFL-CIO and NBS to make the conference presentation. A total of 45 unions supplied inputs to the presentations made at the conference.

Labor generally takes a position of neutrality on metrication, with union spokesmen concerned about workers' investments in tools and the retraining needed during transition. The reports indicate that some unions are unaware that a change is contemplated; many feel that the issue is too remote for any consideration now. The workers in 17 unions have some experience with metric units; those in 28 unions have no metric experience. Those unions that have some experience with metric units feel that the long term advantages of going metric outweigh the disadvantages and disruption of conversion; that changeover is inevitable and should be made as soon as possible.

Sixteen unions feel metrication is either inevitable and/or desirable; four are opposed to metrication; 25 feel the choice of units is of no concern to their members.

Few of the unions anticipate any long term problems once the transition to the metric system is completed. Some feel that metrication would have little effect. Several see positive benefits: a simpler system with less chance of error, easier to understand and remember, and an aid in apprentice training. Workers would also benefit as consumers.

Transition Problems

Some unions believe the transition would take many years; others see it as a temporary problem that would pass. Most agree that transition problems would be less if the change were made rapidly.

The impact of metrication on the worker would be greatest during the changeover period: new tools, retraining, loss of productivity, and new work standards would all need attention. In many trades dual units would have to be used for a while, and this would lead to confusion and mistakes, but the major factor would be human resistance to change, and learning to "think metric." Younger workers coming through apprentice schools would be prepared for metric usage but older workers with many years of trade experience might find the retraining difficult.

Cost of Metric Tools

The cost of new tools that a worker would have to buy under metrication is a major concern of the unions. In some unions this is not an important factor; in others, workers would have to buy new micrometers, scales, wrenches and socket wrenches.

A range of $25 to $150 would appear to cover the costs faced by many workers. Some trades (such as mechanics) might face larger expenditures, perhaps as large as $500 to $1,000. All of the tools needed are readily available today.

Retraining

Worker retraining is the second major concern of the unions. Estimates of actual effort needed are difficult to make, due to varying requirements depending on actual job activities, but it is generally felt that whatever training would be necessary should be at the employer's expense. Most unions feel that existing training programs would be adequate to cover the increased load caused by metrication.

Many unions also express the opinion that retraining might have to focus on the older workers who, with much experience behind them, could be harder to train and teach to "think metric." These steps would be necessary in order to ensure that these older workers would not lose their present jobs or would not be passed over for promotions due to a lack of understanding of the metric system.

Individual Union Inputs

INTERNATIONAL ASSOCIATION OF MACHINISTS AND AEROSPACE WORKERS

In the machine tool industry, metric usage has been occurring for a long time. Foreign trade has been responsible for bringing the issue of metrication into the metal industry, but on a limited scale. The influence of foreign trade has been felt both in relation to imports and exports. The influx of foreign-made cars into the American market has necessitated the use of metric tools. Machine tool companies are manufacturing for export, and there are job shops specializing in maintenance and tooling for foreign-made machines.

The one problem that concerned all those affected by metrication was the cost for the replacement of worker-owned tools. Thus far there has been no need for the worker to purchase special tools. If worker-owned tools become obsolete eventually, it is estimated that the cost for replacement at today's prices would range from $300 to $1,000. No serious retraining program is envisaged.

It is fair to conclude that except for the replacement cost of tools, there is no serious opposition to metrication if it is carried out in a gradual manner over a long period of time. Job shops handling the maintenance and tooling of foreign machines are the most enthusiastic about metrication. However, it is agreed that either the employer or the government should cover the cost of new tools, and also for retraining.

ALUMINUM WORKERS INTERNATIONAL UNION

The Aluminum Workers International Union and its members are not opposed to a change to the metric system but feel that it should be entered into with an educational program within our school system to educate young people to this system some time before it is adopted in this country. To suddenly introduce the older members into this system would be tremendously difficult. The changeover could be easy with groundwork in the schools.

Major problems foreseen in conversion would include tool replacement and retraining. The extent of both vary, of course, with the different occupations. The cost of tool replacement, for example, could be as little as $50 to as much as $1,000.

PATTERN MAKERS LEAGUE OF NORTH AMERICA

Conversion to the metric system would bring about no specific advantages to member craftsmen. The economic impact of the obsolescence of instruments and tools would be severe. The exact cost of tool replacement cannot be determined since it depends on many variables. Because of the basic training of the members, which includes mathematics and related disciplines, the members could convert without any formal or extended training programs.

If there were no Federal grants to remove the economic burden of conversion on the craftsmen, it would be logical to assume that the Pattern Makers League and its local associations would find it necessary to include conversion costs in collective bargaining demands.

AN OVERVIEW OF THE CONSTRUCTION INDUSTRY'S UNIONS

The structure of the construction industry does not readily lend itself to major change. The industry is highly interrelated and both fragmented and decentralized with thousands of companies participating to some extent.

New construction should not be emphasized to the exclusion of renovation, remodeling, and repairing. These would each have an entirely different impact as far as metrication is concerned. If we convert to the metric system completely in the next 10 years, it would be easier to construct new buildings and nonbuildings than to repair the ones now in existence. Many of the buildings now standing will be in existence for the next one hundred years. Constructed and planned on a scale of inches and feet, they would present serious renovation and repair problems.

Another major consideration in the construction industry is its work force. It consists of a large pool of people possessing varying degrees of necessary skills. There is constant movement in and out of this work force, and generally speaking, there is very weak industry attachment. It takes about 1.8 persons to fill one annual job.

Concerning metrication, in construction there is little or no present application and no past experience with the metric system. Existing exports of materials are insignificant now and probably will continue to be in the future. The reasons for that include the weight, bulk, and high cost of transportation.

Accommodation, or even adaption, would be better than conversion for the construction industry. The increased cost and very limited benefits that this industry would receive precludes efficient conversion. Metrication itself should not affect overall construction activity because this activity is limited to the cost and availability of long term capital. The priorities of what type of construction will be built are determined through the flow of this capital. Housing construction could be postponed to give priority to the conversion of plants, capital investments, and plant equipment.

Another factor which would affect the overall construction activity is the quality of the work force. Training would be needed to shift from the customary system to the metric system. Training is probably the most important element in the industry. The capacity of existing apprentice training systems, teaching aids, textbooks, and conversion materials would need to be analyzed; whom to train and how to train him would have to be decided. Recruitment would have to vary with age and geographic distribution. If, for example, a worker lives in a rural area and has to travel to training areas and classrooms, the time spent could be considerable. He should be compensated for time and transportation, creating an additional expense.

Additional concerns include the impact on the earnings of journeymen. There would be a strong possibility of lost income due to delays in scheduling. Also, many persons who are either unwilling or unable to learn, could be forced out of work.

INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS

The International Brotherhood of Electrical Workers has no past experience with the metric system except the use of present electrical units which are metric. The cost of replacing required tools due to metrication would be small. However, a distinction should be made between the tools required by agreements, and tools craftsmen and journeymen carry as a personal convenience to expedite their work. Although the number of tools required by agreement is minimal, the craftsmen actually carry a significant number of additional tools. Reimbursement would probably be limited to required tools. The worker, unfortunately, would have to fund himself the replacement of those other tools. Training is estimated at 30 to 40 hours for journeymen and 50 to 80 hours for instructors at an undetermined expense. Conversion at this time would definitely not be advantageous.

UNITED BROTHERHOOD OF CARPENTERS AND JOINERS OF AMERICA

It is the opinion of this union that with the increase of worldwide trade a uniform measuring system is essential. The members have little, if any, contact with the metric system; therefore, the measuring tools and precision equipment used by the members would be a major problem if the metric system were adopted. Both construction and industrial workers are members in the union, and the replacement value of their tools would vary depending upon the segment of the trade in which they are employed.

An in-service training program of 40 hours for the coordinators and instructors of apprenticeship and journeymen classes would be required. An estimated 20-hour supplemental upgrading program would be needed in order to acquaint members with the metric system.

OPERATIVE PLASTERERS' AND CEMENT MASONS' INTERNATIONAL ASSOCIATION OF THE UNITED STATES AND CANADA

The metric system is not used by the workmen in this industry simply because the advantages are not clear and the unfamiliarity with the system by the membership naturally adds up to an opposing viewpoint.

Conversion to the metric system would be calamitous to the membership, due mainly to the high number of elder members. In the event the use of the metric system is adopted, some kinds of total and absolute compensatory damages must be strongly considered for those who fail to grasp and master the techniques of the new system, thereby reducing or totally losing their earning power. Replacement of tools would be negligible in comparison with the tools and equipment of those in other crafts.

INTERNATIONAL BROTHERHOOD OF PAINTERS AND ALLIED TRADES

The experience of the members with the use of measures is primarily limited to linear and liquid or volume measuring, and most of the membership has been using the English system of measure in their day-to-day work experiences.

No members of the union have any past experience with conversion to the metric system; most members are probably not even familiar with it. Furthermore, there are no readily apparent advantages of conversion from the standpoint of the individual members of the union.

The impact of conversion on members in the building trades, primarily painters, glaziers, and floor coverers, relates mainly to tool replacement. They typically supply many of their own tools. Among the industrial workers, most of the paint makers use employer-supplied equipment. However, the maintenance painters supply many of their own tool kits, and besides painting, they are expected to perform other maintenance functions which may involve the use of micrometers and depth gages. Retraining in both areas would also be a concern. The amount of retraining would necessarily vary according to tradesmen's or industrial workers' present use of the customary system.

BRICKLAYERS, MASONS AND PLASTERERS INTERNATIONAL UNION OF AMERICA

If the metric system were adopted, there would be much resistance to the change at the outset. However, the tradesmen of this union could adapt to a change with fewer problems than other trades. Successful conversion would require coordination of changes between material suppliers, architect designing engineers, and general and masonry contractors through joint meetings and efforts.

Advantages of metric usage may include its ultimate simplicity in calculation. Also, there may be some simplification of processes and construction if the system of measure were unified through the metric system. Greater economies through speed of construction could result if coordinated building design, building materials, and assembly techniques were brought about by a standardized measuring system.

The major disadvantage of metric usage would be costs and delays due to reeducation. A complete reeducation program of all workers would be necessary. There may be a total rejection by some of the older workmen at the outset. There would be some difficulty in job planning and estimating. Worker tool changes would also be required. These include a regular folding rule, 50 feet and 100 feet steel measuring tapes, and a framing square. The costs of such changes would be minimal.

OIL, CHEMICAL, AND ATOMIC WORKERS INTERNATIONAL UNION

If planned metrication is necessary, the conversion should rigidly apply to all segments of industry and no one group should be exempt. Industry must draw labor into its conversion discussions.

Problems would include the replacement of tools. The worker is often solely responsible for the purchase and maintenance of his own equipment at significant cost. Another problem could be the replacement of existing work practices. In chemicals, petroleum and related industries, conversion may require substantial revision of process methods. This could mean the development, installation, and operation of new equipment for which the worker would require training.

The temporary need for maintaining dual working tools and work habits would be expensive and wasteful until such time as the new system is nationally operated.

UNITED MINE WORKERS OF AMERICA

Present unit usage is primarily customary, but there is a growing use of imported (metric) mining machinery. Conversion to the metric system is considered both desirable and inevitable.

The changeover would require a long and intensive transition period. A massive and prolonged effort of public reeducation would be essential. One prime concern of the United Mine Workers Union would be conversion to metric tons from short tons, as royalties on a tonnage base support the UMWA welfare and retirement fund.

UNITED TEXTILE WORKERS OF AMERICA

The members of this union are aware of the necessity for having some uniform method of measurement, particularly as a result of the expanding trade between all nations of the world. The concerns of the workers during conversion would be tool replacement (who would pay for the new ones needed) and retraining. Nevertheless, there would be no real objections to making the change, providing it would not be made too abruptly, but would be spaced over a period of several years.

UNITED HATTERS, CAP AND MILLINERY WORKERS INTERNATIONAL UNION

Conversion to the metric system would not be an insurmountable hurdle for the industry to overcome. The immediate impact would require some minor adjustments in the manufacturing process. To the extent that the introduction of the metric system might have an effect on the present sales policy of the industry to sell any product in dozen quantities, there might be a relearning process required. However, countries on the metric system apparently still use dozens in internal and external sales. Therefore, there would be no objection in terms of impact in this industry. On the positive side, it would help make cost comparisons with foreign markets easier if measurements of length, width, height, and weight were directly comparable.

TEXTILE WORKERS UNION OF AMERICA

The customary system is primarily used in textile operations. Some textile mills are using imported machines made in foreign countries using the metric system. These require the use of special tools by mechanics, repairmen, or fixers, but this has not created any problems.

Concerning a possible change to the metric system, the great majority of textile workers are machine tenders and the effect of conversion on their work routines would be negligible.

No significant advantages or disadvantages would result to members on the job. The average individual would find the metric system simpler, after a short adjustment period. Familiarity with the U.S. monetary system should make the transition easy.

A relatively small number of worker-owned tools such as micrometers, verniers, wrenches, etc., might become obsolete. These are used by only a small percentage of textile workers and sometimes supplied by the employer. The cost of replacement would be negligible or small for most textile workers.

Training programs may become necessary for some of the skilled trades workers who utilize measures such as weights, pressures and volumes in dyeing, finishing, coating, and similar textile operations to familiarize them with the metric system. This could be done by the employers in the plant in a short time.

INTERNATIONAL LADIES' GARMENT WORKERS' UNION

There is no prior experience in conversion or in the use of the metric system in the production of apparel in the United States, whether made by cut-and-sew or knitting processes. Any conversion to the metric system would require certain adaptations in the industry. There are relatively few worker-owned tools that might be affected. Some sewing machine operators own measuring tapes and other minor tools that would require changing.

The main problem in conversion, from the worker's standpoint, would be an educational one. For example, stitch lengths in sewing are expressed in stitches per inch. Adjustment mechanisms found on sewing machines are expressed in these terms. In view of the comparatively long life of this equipment, many machines with present adjustment markings would continue to be utilized even after a conversion to the metric system; this might add to confusion in the shops.

In the shop, workers in the cutting room would possibly have to get used to different widths of fabric that the introduction of the metric system may bring, again assuming that fabric width would be changed to a whole number of centimeters. However, the marking of patterns on fabrics of slightly different width would present only an educational problem to the worker that would not be insurmountable.

BOOT AND SHOE WORKERS' UNION

The greatest impact from conversion in the shoe industry would fall on the manufacturers.

The major impact for the shoeworker would be confusion with new units. Some impact may result in teaching operators to check their various parts by centimeters rather than by irons or eighths of inches or other fractions of inches. Piecework operators who now receive pay based on linear measurements could become confused and even suspicious if the conversion is made to centimeters.

AN OVERVIEW OF THE TRANSPORTATION INDUSTRY'S UNIONS

Transportation unions see little, if any, advantage to their members in converting to the metric system of measurement. On the other hand, no serious opposition to conversion from these unions would be likely to arise providing that the investment of workers in their tools would be protected, necessary training would be provided and disruption in established seniority systems and other collective bargaining arrangements would be minimized.

The financial burden of tool replacement must not fall on the worker. Unions would not be willing to accept the idea of "let the cost fall where it may." If there is an advantage to industry and to government in converting to the metric system then industry and government should bear the cost. The advantage to an individual worker would be too remote in benefit and time to put the burden on his pocketbook.

In all transportation modes there are situations where safety is a primary factor and where rapid decision making is required. In these instances proper off-the-job training must be furnished.

Although proper training would probably be the most important single step to accomplishing smooth conversion, it would not present serious problems if it could be undertaken within the present institutional collective bargaining arrangements between employers and unions.

Metrication would have to come about without upsetting seniority by allowing younger workers to bypass their seniors just because the former are more versed in the metric system. This could be avoided by putting more emphasis on the training programs for older workers—to make sure that no worker is denied a job to which he would otherwise have been entitled if conversion had not occurred.

INTERNATIONAL UNION, UNITED AUTOMOBILE, AEROSPACE AND AGRICULTURAL IMPLEMENT WORKERS OF AMERICA

At present the metric system of measurement is used in only a small percentage of auto, aerospace and agricultural implement plants in the United States. There it is mainly used in the tool and die and modelmaking trades. In the plants where the metric system has been introduced on a limited basis there have been problems that have arisen.

One of the main problems is the cost to the employer for conversion to the metric system of the machines now in use. The second problem experienced is the cost of replacing the workers' tools, especially in the metal trades classification. No formal training programs have been established; this would indicate that the workers learn as they get involved.

Advantages to the worker of a conversion to the metric system seem nonexistent. The primary disadvantage of a change in measuring systems would be the cost of replacing the workers' tools, mainly in the metal working trades. Tool replacement for workers in the tool and die trade could cost as much as $450. Other trades, i.e., electricians, patternmakers, etc., would also be involved although not to the extent of the tool and diemakers.

Training would be another area of concern. U.A.W.'s formal and sophisticated apprenticeship programs would need to be revised to incorporate the metric system of measurement. The length of time necessary for these training programs cannot be established. If the change were put into effect naturally, the training programs could get shorter as the change continued and the employees through custom became familiar with the metric system.

AIR LINE PILOTS ASSOCIATION

Most pilots feel that metrication is inevitable, especially those with international experience; and a good thing in view of its acceptance by the rest of the world. There is a definite advantage in being able to perform mental calculations using a system of units with a base 10.

However, during a transition period, the retraining of pilots would be the most serious economic and personal hardship, and the lack of experience with the new units could pose a serious safety problem.

MARINE ENGINEERS' BENEFICIAL ASSOCIATION

The scope of measurements used by marine engineers covers a wide range and a change from customary measurement units to the new International System of Units would have a major effect on the members.

During the past several decades a limited number of engineers have had experience with the use of metric measurements primarily on foreign built vessels. Experience in working on such vessels has shown that the worldwide availability of parts and labor is greater, and if repairs are required overseas, the extensive conversion required in converting the job specifications from English to metric units is eliminated.

During conversion to the metric system, the primary disadvantage would occur during the period when the new system is put into effect. The practicing engineers would have to be trained in the use of the new system; the trainee engineer would have to be trained in two systems of measurement. Fortunately the educational level of the membership is quite high, therefore the training periods would be rather nominal. To date all training has been accomplished by on-the-job training.

The primary long-range problem that would face the membership by this industry converting from the English system to the metric system would be a radical change in job characteristics. The average U.S. flag merchant vessel has a life span of approximately 25 years; the manufacturers and vendors of ships' equipment carry spare parts for approximately 3 years by requirement. Fortunately, the manufacturers of most marine equipment have not changed their basic designs for the past several decades which results in having spare parts for the life of a vessel. With the adoption of the metric system, the subsequent retooling of the marine component manufacturers would rapidly eliminate the availability of spares, requiring that the ships' engineers either do more shipboard machine work or develop newer techniques for repairs.

UNITED TRANSPORTATION UNION

People primarily represented by this organization are those engaged in the movement of trains and engines on the tracks of the United States and Canadian railroads. The facilities that are utilized in such movement, as well as the "tools of the trade" which are lanterns, flares, signal flags, etc., have no direct relationship to the measurement system used, and, accordingly, there would be no impact if the metric system were adopted.

UNITED TRANSPORT SERVICE EMPLOYEES

The United Transport Service Employees, and its members, strongly support and urge the adoption of the International System of Units (SI). However, it would necessitate the establishment of area-wide classes of instruction for people who are not attending schools or colleges in order that they could become familiar with the usage of the metric system.

There would be no apparent advantages or disadvantages to transport service workers in converting to the metric system due to the nature of the members' work. No worker-owned tools or equipment are required in the performance of their duties.

INTERNATIONAL ORGANIZATION OF MASTERS, MATES AND PILOTS

If the United States were to convert to the metric system, it would be welcomed by the members of this organization. In general, the average Deck Officer would have no serious problem in adjusting himself to the use of the metric system in his daily assignment.

Ships' Officers in their duties in meteorology and weather are used to handling their assignments using the metric system, e.g., by expressing temperatures in Celsius, and millibars for barometric pressure. Ships' Officers, in their daily work in cargo operations, find that most cargo documents express weights in kilograms. When heavy lift is expressed in kilograms, this in turn is converted by the Officer to pounds because the ships' cargo gear capacity is expressed in lifting ability in long tons. In many places in the world the Deck Officer is involved, for example, with Docking Officials who, in many cases, express length in meters instead of feet.

For the average Ships' Officer, there are no serious difficulties experienced in these conversions. However, if the conversion to the metric system were put into effect, it would simplify matters for the Deck Officers.

AMALGAMATED TRANSIT UNION

Early transition to the metric system appears to be in the national interest in order that American-made tools and machinery and other consumer products may have a much broader export market. Obviously, the export market is increasingly resistant to the idea of carrying a duplicate inventory of tools and skills to accommodate the American-produced products.

However, the advantages of a changeover to the metric system are not readily visible or apparent to workers in the transit industry, particularly when they have not had any previous exposure to the use of the metric system. Since metric units are divisible by 10 in all of their multiples or submultiples, a far greater degree of facility, efficiency, and therefore improved productivity, is possible.

Disadvantages to the transit worker which would accompany metrication are in reality cost problems relating to tool replacement, redrafting of maintenance specifications, either by changing completely to metric, or by giving metric equivalents during the transition period; and the training of employees to the metric system.

BROTHERHOOD OF RAILWAY, AIRLINE AND STEAMSHIP CLERKS, FREIGHT HANDLERS, EXPRESS AND STATION EMPLOYES

The United States has been adjudged in many areas as a world leader. With more than 80 nations already on the metric system, it behooves the U.S. to join with the rest of the world in this endeavor. The workers represented by this union would not be materially affected by conversion to the metric system. However, the union is convinced that the conversion should take place and the cost absorbed as it would provide for a freer exchange of scientific data and common standards for easier exporting and importing of materials.

The greatest advantage of a conversion to the metric system would be an improved exchange of information with persons of like interests in other countries. Over a 10-year period, disadvantages would be minimal. Not more than 2 percent of the members would be faced with purchasing new tools. Over 10 years with normal wear and tear, and depreciation, there would probably be no cost to the worker.

It would be essential that members who make computations in distance be given a brief orientation coupled with the issuance of conversion tables.

LITHOGRAPHERS AND PHOTOENGRAVERS INTERNATIONAL UNION

With the world shrinking as a result of continually improving communications, global standardization of measuring systems is more and more imperative and it will be necessary for the graphic arts industries to adjust accordingly.

It is very obvious that in adopting the metric system, all industries would encounter difficulties in varying degrees. Manufacturing industries would have the most serious problems and the graphic arts industries are in that category.

It is apparent that it would be necessary for all industries to embark upon vast educational projects to properly train and convert workers to the metric system. The Lithographers and Photoengravers International Union is already geared to meet that situation.

The LPIU Educational Training and Retraining Program enables graphic arts craftsmen to attend courses of instruction which are specifically designed to keep their knowledge and skills in pace with the needs of the industry. The physical requirements and instructional system are already well established and any new subject could be added to the curriculum with a minimum of difficulty. If the United States adopts the metric system, the Lithographers and Photoengravers International Union, through its Educational Training and Retraining Program would be ready for a massive conversion program.

NATIONAL ASSOCIATION OF BROADCAST EMPLOYEES AND TECHNICIANS

This report is based on a questionnaire survey of the chief engineers at radio and television broadcasting stations, and officials of the National Association of Broadcast Employees and Technicians.

The advantages of conversion to the metric system far outweigh the disadvantages in the broadcast industry. The industry is already using many electronic measurements and standards expressed in metric terms.

A major advantage of conversion relates to the need for uniformity throughout the entire spectrum of worldwide electronic communications. The advent of computers and satellites marks an even greater need for worldwide standardization. More and more electronic equipment of foreign design and manufacture is entering the United States, and the need for such uniformity is even more urgent.

There is broad concurrence among the respondents that the main disadvantage – and a minor one – in conversion to the metric system would be in the measurement of footage of audio tape, video tape and motion picture film for purposes of time computation in the day-to-day broadcast operations as relates to program scheduling. Here it is believed that even though the impact of conversion would be immediate, the acceptance of the new standard would be easily accomplished because of the high skills and competence prevalent among the employees in the broadcast industry.

Tool replacement would not be of great concern to the workers because in the broadcast industry the companies supply, for the most part, all of the tools and equipment used. There should be no need for any extensive training program for employees in the broadcast industry, assuming the availability of a comprehensive series of conversion tables.

A conversion to the metric system should neither create any insurmountable problems in the recruitment of employees or in the promotion of employees, nor should conversion have any significant effect on the nature of the jobs of the employees in the broadcast industry.

INTERNATIONAL PRINTING PRESSMEN AND ASSISTANTS' UNION OF NORTH AMERICA

Advantages of a metric conversion for workers in this facet of the printing industry would be in the form of a spin-off benefit related to expanded employment opportunities. This would appear to be a deferred or long-range benefit.

Job-related tool replacement costs would be minimal for printing press operators in a changeover. Workers engaged in maintenance and repair, however, would have a substantial investment to make in personal tools. Normal depreciation, breakage and obsolescence over a 10-year period would not necessarily offset the need for maintenance workers to secure a complete set of metric tools at one time. This would be required at the moment a metric press is introduced into a plant which previously had no metric equipment. Due to the long life of capital equipment in this industry, dual usage of measurement systems, particularly for maintenance, would be prolonged. Maintenance machinists, electricians, etc., would be required to own two sets of tools for a good many years past completion of conversion.

Training should not be confined to only those workers directly engaged in measurements in the performance of their jobs since this ignores the fluidity of the work force. Denying adequate metric training to any and all workers might limit promotion opportunities or limit geographical mobility of individuals who would relocate to improve their earning capacity. In printing it is probably more characteristic than in other industries for employers to rely on the mobility of workers to secure adequate manpower.

INTERNATIONAL UNION OF ELECTRICAL, RADIO AND MACHINE WORKERS

The report is based on a questionnaire survey of local unions.

There are several classifications of jobs which probably would not be affected by metrication. These are the repetitive, short-cycle production line jobs in which very little measuring is done. Highly skilled personnel—such as technicians and engineers—would be affected by a changeover, but indications are there would be few problems regarding acceptance.

Approximately 15 percent of IUE members are skilled tradesmen (maintenance men, machinists, tool and die makers, etc.). These are the workers who would be the most seriously affected by the introduction of the metric system. They would be affected in two ways: (a) the cost of tool replacement, and (b) the need for additional training in the use of the metric system.

The greatest objection voiced in all replies is the cost of new tools due to conversion of machinery over a period of years. The type and replacement cost of tools depends on the job.

All respondents believe a retraining program would be necessary. This should consist of classroom instruction as well as on-the-job guidance. A gradual changeover—with the use of conversion charts—would be necessary to allow workers whose adaptability rates differ, to pace themselves accordingly.

COMMUNICATIONS WORKERS OF AMERICA

There are no immediate advantages from conversion that would accrue to the non-supervisory workers in the telephone and telegraph industry. In the long-run, however, conversion to the metric system by all nations would greatly facilitate the exchange of goods and information.

One of the principal immediate disadvantages would be the tremendous inconvenience that would be caused those workers involved in measurement—particularly in the manufacturing arm of the industry and in installation. In addition, habits and custom—particularly those involving measure—would be difficult to break, could cause the workers great concern and eventually lead to errors and disciplinary measures.

Skilled craftsmen represented by the CWA would suffer greatly from obsolescence of tools. Because of the many skilled crafts represented and the differing tool requirements for each one, any estimate would be difficult at best. Training would also be a problem but it is impossible to judge the needed effort.

In view of the problems that are encountered when complete conversion is employed, it would appear that the minimal response to the metric system or "accommodation" should be first employed. If this minimal approach can be digested, then the second and third degrees of response, after proper intervals, could be utilized. This procedure should be employed if the metric system were adopted because of its gradual approach.

THE ASSOCIATED ACTORS AND ARTISTES OF AMERICA

The Associated Actors and Artistes of America reports that their members have essentially no use of measuring systems in their activities and as such would have no problems if and when the metric system were adopted in the United States.

AMERICAN NEWSPAPER GUILD

The American Newspaper Guild reports that their members have essentially no use of measuring systems in their activities and as such would have no problems in performance of their job functions if and when the metric system were adopted in the United States.

SERVICE EMPLOYEES INTERNATIONAL UNION

Discussions with representatives of member locals in the United States and Canada lead to the observation that the bulk of the membership would not be greatly affected by a conversion to the metric system.

In general, it should not place any great burden on the membership. Some of them would have to undergo some instruction in the transposition and use of the system, but such instruction would probably not have to be extensive.

Most of the members are not required to purchase their own tools. Accordingly, there would seem to be no costs involved for them individually in the changeover.

INSURANCE WORKERS INTERNATIONAL UNION

There is almost no interest, pro or con, about conversion to the metric system among the members of the Insurance Workers International Union. Because of the nature of the industry, any impact from such a change is apt to be minimal.

INTERNATIONAL UNION OF UNITED BREWERY, FLOUR, CEREAL, SOFT DRINK AND DISTILLERY WORKERS OF AMERICA

The union is opposed to conversion to the metric system. The reasons are the possible costs of the changeover of tools, machine tools, and containers of all sizes. Education is also considered to be a big problem.

NATIONAL ASSOCIATION OF POST OFFICE AND GENERAL SERVICES MAINTENANCE EMPLOYEES

It is the feeling that the use of the metric system would have no great impact on members of this organization as presently set up, unless the size of nuts, bolts, and tools, etc., are changed.

THE NATIONAL ASSOCIATION OF SPECIAL DELIVERY MESSENGERS

The National Association of Special Delivery Messengers feels conversion to the metric system would have no effect on its membership.

NATIONAL FEDERATION OF POST OFFICE MOTOR VEHICLE EMPLOYEES

The National Federation of Post Office Motor Vehicle Employees feels that conversion to the metric system would have no effect on its membership.

OFFICE AND PROFESSIONAL EMPLOYEES

A changeover to the metric system would bring no great advantages or serious disadvantages for union members. The overwhelming majority of office and other white-collar employees do not use any tools, instruments, or machines that would have to be replaced if the metric system were adopted. No extensive educational programs for white-collar employees would be needed if the United States decides to adopt the metric system.

RETAIL CLERKS INTERNATIONAL ASSOCIATION

A conversion to the metric system of measurement would produce minimum benefit to store workers, but at the same time the detrimental aspects would be slight.

The advantages or disadvantages of converting to the metric system in the retail industry appear to be minimal. The disadvantages relate to the necessity of reeducation of the workers to a system with which they have virtually no familiarity. However, the metric system is fairly simple to learn. Retail workers use the measuring equipment supplied by their employers. Therefore, there would be no direct cost to them in any conversion.

UTILITY WORKERS UNION OF AMERICA

In the utility industry, conversion would cause no real difficulties. Most workers are highly trained and could learn and adapt easily.

ALLIED INDUSTRIAL WORKERS OF AMERICA, INTERNATIONAL UNION

Voluntary conversion would create additional pressures at the bargaining table. The employer's side of the table would see additional costs in equipment and also the short-run loss in productivity. There is no question that the conversion would slow down the rate of increase in productivity (if not actually cause a decrease) in the short-run.

From the union's side of the table, the pressures would be on the union for wage increases to cover the additional tool cost to employees or have the employer purchase the tools. Unions would also be seeking protection of seniority rights in job upgrading through job bidding procedures. Unions have enough experience with subjective management judgment regarding ability without adding one more screening out criteria (i.e., knowledge of the metric system).

AMERICAN FLINT AND GLASS WORKERS UNION

The American Flint and Glass Workers Union's skilled mechanics have an average of $500 to $600 invested in precision tools and the protection of this investment is of great concern. They see no particular advantage in conversion to the metric system to offset the increase in costs.

GLASS BOTTLE BLOWERS ASSOCIATION OF THE UNITED STATES AND CANADA

Since the nations of the world are gradually accepting the metric system, this nation cannot remain alone with a system of measurement of its own. More and more of the products made by the members are exposed to international markets and to make them more acceptable they must be in units of measure in use in the purchasing country. This exportation of the members' products is an important factor in maintaining stable employment and in expanding job opportunities for the workers. The glass container is very versatile and the manufacturer and customer are very innovative. Because of this fact, changing glass or plastic containers to metric sizes would be almost routine.

With the exception of the workers employed in the maintenance departments and machine repair departments, very few of the workers represented by this union are required to furnish tools or equipment. Most of the tools used by the average worker are the kinds that were developed specifically for this industry and since they would be of no use in some other job or industry, are supplied by the employer. A conversion to the metric system would have to be gradual. No special training program would be required to convert the workers represented by this union to the metric system.

INTERNATIONAL LEATHER GOODS, PLASTICS AND NOVELTY WORKERS' UNION

Both the customary and the metric system can be conveniently used by the workers. Of course the introduction of a new system would entail more difficulties than maintaining the status quo. However, if there were a consensus that a new system should be introduced, this union would concur in such a consensus and would urge that appropriate educational measures be undertaken to assure its proper implementation.

INTERNATIONAL MOLDERS AND ALLIED WORKERS UNION

The simplicity of the metric system and its widespread acceptance in a major part of the world, demands thoughtful and intelligent consideration on our part. This union welcomes a study of the systems, realizing that an understanding and an agreement could have a good effect upon the economies of the world. If agreement can be reached upon an international system of measures and weights, the United States might advance quickly to other agreements.

A training program for workers should be initiated by all industries if and when a decision to convert is reached. It seems that it would be a proper function of the government to help defray the cost of such training. Although a period of 10 years has been discussed as an orderly transition period, it should be possible to shorten the time.

UNITED FURNITURE WORKERS OF AMERICA

It is always desirable to institute for universal use a uniform system in any area. Our current money, electrical and number systems are based on units of 10. It is therefore logical to conclude that to change a similar system of weights and measures should not be difficult.

Once the metric system is introduced and workers become accustomed to it, they would find it easier to use. It would also result in greater uniformity in tools, nuts, bolts, screws, and other such hardware used in the furniture trade.

It would be necessary to institute a training program to teach workers in the plants not only the system, but to relate it to the use of tools.

Most workers are conservative when it comes to changing from a system or method to which they have long been accustomed. However, once the people in the industry master the use of the metric system they would probably never want to change back to the current system of measuring.

Certain cost factors would be involved, however, for the skilled workers—cabinet makers, upholsterers, etc., since many of their tools would become obsolete, and the purchase of new tools produced in the metric system would be required.

V. THE CONSUMER

A SUMMARY OF INPUTS

Inputs in the consumer area were obtained with the special assistance of the American Home Economics Association. Reports were made by specialists in ready-to-wear clothing and yard goods, in health products, fresh and processed foods, food preparation in the home, and kitchen and household equipment.

The experts agree almost unanimously that conversion to the metric system would bring advantages outweighing disadvantages, and that metrication would offer no great problems in converting clothing, food, and home equipment. The feeling that the change is inevitable and would cost more if delayed is also commonly expressed. It is also noted that at present most consumers are disinterested or apathetic, and a massive educational program would be needed.

Advantages

A major advantage of metrication for the consumer cited by the experts is that the metric system is simpler, with little use of fractions and only one unit for any quantity. It would therefore be easier to learn and calculations would be less subject to error. Also, price comparisons would be easier to make, and calculations in home food preparation would be simpler.

Another advantage would be that changing to the metric system would bring opportunities to introduce sizing methods based on actual body dimensions for some types of clothing. Finally, some experts feel that with more products exported and imported, the range of choice for the consumer would be wider and costs could be reduced.

Disadvantages

Disadvantages to consumers, according to the experts, would be limited to getting accustomed to a new system, with some confusion and possible temporary cost increases during a transition to the metric system. Surveys conducted by many of the participating organizations show that consumers generally are unaware of any contemplated change to the metric system and see no reason to change. Consumer education to the metric system is expected to present more difficulty than any other aspect.

The time required for conversion, in general based on inventory turnover time, ranges from a few months for food to 5 or 10 years for appliances and equipment. All experts favor a coordinated conversion program with a fixed date for completion.

Education for Consumers

The reeducation of the U.S. consumer to a new system would be a major problem in metrication. Preparation for conversion would require six months to a year of planning. Teachers would need to be trained before any massive educational program could be started, and sales clerks would need to be trained to assist customers.

A survey of consumer attitudes to uncover opportunities to arouse interest and provide motivation for the change to the metric system would be very useful. Such a survey could help develop a strategy for winning broad popular support for metrication. Advertising would be one of the ways of achieving this support, through TV commercials and in print, as has been done in the past for other public interest causes.

Spokesmen for Consumer Activities

PURCHASING WOMEN'S READY-TO-WEAR CLOTHING

Presented by:

Dr. Margaret Warning
College of Home Economics
Iowa State University

The present system of sizing has been established by practice through the years without a consistent plan and is often confusing to the buyer. Where sizes refer to actual physical measurements, they are exclusively in terms of customary units, and garments partially constructed in foreign countries for marketing in the U.S. are labeled according to U.S. practices.

Planned metrication would have the following advantages: (1) adoption of uniform national and perhaps even international standards for clothing sizes; (2) possibility of having the actual dimension of garments on the label so that consumers could know what they were selecting rather than having to interpret sizes; (3) simplification of international trading and shopping in foreign markets made easier; (4) less difficulty in transferring highly skilled garment workers from abroad to work in U.S. production.

These would be accompanied by the following disadvantages and problems: (1) the psychological disadvantage associated with learning and adjusting to new measurements; (2) rounding may produce new sizes; (3) a possible increase in the cost of garments resulting from increases in manufacturing costs.

PURCHASING CHILDREN'S CLOTHING

Presented by:

Elsie K. Williams
College of Home Economics
Iowa State University

Whether produced domestically or foreign made, all children's clothing is sized by the customary system. The present system of sizing is inconsistent and often confusing. Infant and toddler clothing often is sized with an arbitrary letter or number accompanied by a height and weight chart. Similar standards have been developed for boys, girls, sub-teens, and teen-age girls, but rarely are clothes for these age groups sized by height and weight.

A program of planned metrication would provide an opportunity to change to a logical labeling system which would include critical body dimensions. Standardization of sizes is not necessarily advantageous since differences in manufacturers offer flexibility to consumers and an opportunity to select cuts and styles that fit the buyer's body type.

Advantages would include easier selection of prepackaged infant wear; and more accurate mail order purchases would be possible.

There may be a psychological disadvantage associated with learning and adjusting to new sizes and measurements.

PURCHASING MEN'S CLOTHING

Presented by:

Dr. Margaret Boyle Conte
School of Home Economics
Purdue University

Men's clothing is sized according to the customary system whether made domestically or imported. Some American sizes are related to body measurement (i.e., actual neck or chest girth in inches).

Metrication would probably have a minimal impact on the consumer of men's clothing. Under a program of planned metrication, no particular advantages would be forthcoming. New sizing would need to be carefully planned to offer the most customer satisfaction. A reduction in the number of sizes could decrease satisfaction.

HOME SEWING, YARD GOODS AND PATTERNS

Presented by:

Mildred Graves Ryan
The McCall Pattern Company

The customary system is used exclusively in all phases of home sewing. The sewer may use items, trimmings, buttons, buckles, fabrics, ribbons and sewing machines that have been made in metric countries according to metric engineering standards, but in doing so she uses the customary system.

Planned metrication would necessitate the establishment of new sizes for many of the items used and new dimensions for others. These changes could be expected to cause difficulties and be met with resistance by many consumers. The time needed to adopt or adjust would depend on the intelligence of the home sewer, her attitudes, the attitudes of those who brought the change, and the attitudes of those who introduce her to it.

The pattern companies would present the home sewer with the information she would need to purchase her patterns and fabrics. She would not need to convert any of her measurements. Items that would have to be replaced include a rule and tape measure that total approximately $2.00.

PURCHASING PROCESSED FOOD

Presented by:

Dr. Jean A. Phillips
College of Home Economics
Virginia Polytechnic Institute and State University

Current legal restrictions are such that the customary system is used in retail markets for all foods. Some contents are given in metric units but only as parenthetical information. With the familiar customary system, some confusion does exist between weight and volume when the term ounce is used.

A planned program of metrication would aid in eliminating present ambiguities. Different units in the metric system for mass and volume would aid consumers. Elimination of sub-units like 16 ounces per pound would facilitate calculations. The major disadvantage would be the need to educate the consumer.

PURCHASING FRESH FOOD

Presented by:

Majorie M. Merchant
Extension Management and Family Economics
University of Massachusetts

Purchase of fresh meats, fruits, and vegetables is done exclusively by the customary system (pounds, gallons) or by count. There is no trend toward introducing the metric system, and, at present, price comparisons can be easily made.

Under planned metrication, the number of language, unit and size changes would be minimal for the consumer engaged in purchasing fresh foods and the impact would also be minimal. The consumer would need to be educated to recognize changes in sizes and in pricing and to learn to think and base purchases on the new units.

HOME FOOD PREPARATION

Presented by:

Fern E. Hunt and Eloise Green
School of Home Economics
The Ohio State University

Recipes, measuring devices, and cooking utensils are all presently in terms of customary units for home cooking. Under planned metrication, there would be no difficulty in converting from Fahrenheit to Celsius for temperature measurements in cooking although conversion tables would be needed. A change to cooking by weight would create problems and women would probably prefer to continue to cook by volume measuring. It would be desirable to retain the relationship between basic proportions as those now existing between the cup, tablespoon and teaspoon. Careful planning and thought would be needed in establishing metric measuring devices for use in home cooking.

Advantages of metrication would include: (1) simplification of calculations and comparison of diets, formulas and recipes; (2) easier international exchange and use of food preparation information; and (3) easier international exchange of utensils and measuring equipment for food preparation. The major disadvantages would be the obsolescence of presently owned and used utensils, measuring devices and recipes from the standpoint of markings and language. The cost of new measuring items would be less than $10.00 per household.

KITCHEN EQUIPMENT

Presented by:

Helen M. Goetz
Department of Home Management
University of Alabama

At present there is exclusive use of customary units in the description, directions for use, and indication and control of kitchen equipment. The homemaker is not handicapped by the use of customary units and would not benefit from the use of metric units.

Under planned metrication the consumer would be required to learn new nomenclature but no mass confusion is foreseen since kitchen equipment is not acquired often and afterwards the consumer does not concern herself with measurements that are important at the time of purchase.

THE PURCHASE AND USE OF HOUSEHOLD EQUIPMENT

Presented by:

Mary E. Purchase
Department of Design and Environmental Analysis
New York State College of Human Ecology
Cornell University

At present all items of household equipment utilize exclusively customary units. There is increasing use of metric language as parenthetical information, but this is of no concern to the consumer.

Under planned metrication there would be no advantage or disadvantage to the consumer in this area. No special education would be required – general metric education would be suitable.

Any change in the physical sizes of appliances to make them in round metric units would be small and of little concern to the consumer, provided that the new sizes were not too large to pass through existing doorways.

THE PURCHASE AND USE OF HOUSEHOLD FURNISHINGS

Presented by:

Stanley H. Slom
Home Furnishings Daily

At present customary units are used exclusively for the purchase and use of household furnishings. This causes some problems for the consumer (e.g., converting from square inches to square feet to square yards).

Under planned metrication there would be no significant problems to the consumer. The width of carpeting, upholstery fabrics, and drapery materials may change but this would be of more concern to the manufacturer than to the consumer.

REPAIRS AND SERVICING

Presented by:

Henry N. Ostborg
Merchandising Testing and Development Laboratories
Sears, Roebuck and Company

At present there is very little use of metric language or metric engineering standards in repairs and servicing; primarily the customary system is used. Items purchased outside the continental United States and built to the metric system have created no serious problems for Sears and/or its customers.

Under planned metrication the success of such a program would depend on good planning with a reasonable rate of change. The rate of conversion should fit changes brought about by normal product design innovations and improvements and/or the improvement or replacement of manufacturing equipment or methods. If this procedure were followed, the duplication of repair parts inventory could be held to a minimum. Training of sales and service personnel could be accomplished as part of the normal training necessary for any product change. This would minimize confusion and total cost both to industry and the consumer. (This report is based on the experience of Sears, Roebuck and Company.)

METRIC LABELING FOR FOODS, DRUGS AND COSMETICS

Presented by:

Wallace F. Janssen
Food and Drug Administration

Only through complete conversion and standardization of sizes could the consumer-purchaser obtain substantial direct benefits from metrication. Merely to place metric numbers on English units of quantity would not simplify the shopper's arithmetic or aid in price comparisons.

As to health products and services, the U.S. has already converted very largely to the metric system. Prescription medicines and many other medical products are manufactured, controlled, labeled, and administered in metric units. That change was evolutionary and voluntary, stimulated by the practical advantages of a scientific and more easily used system. It was beneficial and has had no adverse impact on the consumer.

AUTOMOBILE PURCHASING AND USE

Presented by:

Harry Murphy
Chairman
Department of Marketing
University of Dayton

Domestic automobiles are manufactured primarily to customary engineering standards. Of course, imported automobiles use metric standards extensively. The producer-seller provides purchase and use information converted into customary units.

Under planned metrication, a change of measurement language only would be confusing and the benefits of metrication would probably not be achieved; a change in standards to rounded metric quantities would be required. Conversion to the metric system would result in consumer confusion and resistance. Adjustments in the purchase of gasoline and oil and in the inflation of tires would be more readily and safely dealt with than the problems of conversion confronting the driver of an automobile. These could be a problem if mental conversions of road sign information are confusing at high speeds on expressways.

AUTOMOBILE REPAIR AND SERVICING

Presented by:

Herbert E. Ellinger
Transportation and Technology
Western Michigan University

Domestic automobiles are based on and use the customary system. Foreign automobiles are generally engineered to the metric system. The volume of imported cars is steadily increasing and for those consumers that do their own servicing it has required a modest purchase of metric tools. There is difficulty in getting satisfactory service when the consumer takes his foreign car to an independent repair shop or service station. This is primarily because of the poor availability of replacement parts and not the fact that metric standards were used to manufacture the parts. Service on foreign cars is comparable in cost to service on domestic cars.

Metrication would cause no serious problems at the consumer level in automotive service. The service man, with some training and suitable tools, should have no trouble servicing metric designed and engineered cars. The consumer could be affected by those service men who are untrainable or refuse to be trained. Any added cost would likely be passed along to the consumer.

CONSUMER ATTITUDES: "A CROSS-SECTION OF ATTITUDES"

Presented by:

Margaret Dana
Consultant, Consumer Attitudes

In response to a request in Mrs. Dana's newspaper column, 219 persons wrote letters giving their opinions about the metric system and a possible change to it in this country. They came from all parts of the country, all age and educational levels, and many occupation categories.

Figures ran about 10 to 1 in favor of metric conversion. The letters emphasized:

1. The metric system is easy to use
2. The metric system is easy to learn
3. Some elderly people would have a difficult time adjusting
4. A barrier would be set up between Americans and others if the U.S. does not change.

The overriding conclusion from the survey is that metrication has greater consumer support than is usually realized.

CONSUMER ATTITUDES: EDUCATION

Presented by:

Theodore Dunn
Benton and Bowles (Advertising Agency)

Advertising seeks to find out what consumers need and want and, through education and motivation, to sell products and services. Advertising develops a strategy for selling a particular item, executes it, and checks whether or not it has accomplished its objectives. These principles could be applied to the introduction of the metric system.

Knowledge of the metric system and the motivation to use it would alleviate many, if not all, of the difficulties. Lack of advantages and motivation of consumers for metrication could be compensated for by borrowed motivation. Metrication would probably not be met with a great deal of resistance, but rather apathy and indifference born out of lack of knowledge of the values of the new system and of reasonable satisfaction with the old. Advertising could help provide the knowledge and motivation necessary to overcome this apathy.

Individual Group Inputs

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

This report is based on a survey of representative consumers conducted by the National Rural Electric Cooperative Association. Generally, those consumers who are familiar with the metric system and have used it professionally or in school favor a change and do not feel it would be difficult. Those people who have not had contact with metric measurements are opposed.

Respondents indicate knowledge of the metric system in such items as electrical units, film, drugs, school, and foreign cars. About half state that they have no occasion to use metric measurements. Responses indicate that those who have used metric measures do not find it difficult. Three out of five indicate no disadvantages in the present system. A majority indicate that they have heard metric terminology; fewer can define the meanings, and still fewer use such measurements.

CONSUMER INTEREST COMMITTEE—AMERICAN HOME ECONOMICS ASSOCIATION

The Consumer Interest Committee of AHEA surveyed members in business, education, research, and homemaking.

Reeducation and adjustment is identified by most as the major effect of a change to the metric system on the field of home economics, the home economist as an individual consumer, and the total consumer population. The degree of concern and needs on the part of a majority of the respondents in the survey is directly proportional to familiarity with the system. Home economists currently involved with metric measurements generally envision minor changes in equipment and materials, and as a result, minimum cost to their position in home economics and to their role as consumers. Those respondents less familiar with the metric system tend to view a change to the metric system as very costly in money and time, both to their position within home economics, and to their own households in terms of replacement of equipment and educational materials.

Among home economists answering questions on advantages and disadvantages of a change to the metric system for American consumers, 23 percent feel there is no consumer advantage to such a change. Thirty-four percent of the respondents feel the major advantage to be that of conformity with the other countries of the world, a situation that would have indirect benefits for the consumer. In contrast, 61 percent of the sample see a direct consumer advantage to the complete use of metric measurements through easier price comparisons in the marketplace.

Home economists see initial confusion and adjustment as the major disadvantages of a change to the metric system. Concern is expressed for extensive consumer education efforts and the development of easily interpreted educational materials relating to conversion factors. The cost of replacing household equipment is the second most often stated disadvantage to complete adoption of metric measurements.

HOME ECONOMISTS IN HOMEMAKING SECTION AMERICAN HOME ECONOMICS ASSOCIATION

This report is based on a questionnaire survey of the Home Economists in Homemaking Section's members. The respondents indicate the greatest advantage of present customary usage is its familiarity, and the disadvantages most frequently cited are the use of necessary fractions and the inability to correlate the measures.

The advantages of metric system usage listed most are its universality for world trade and communication, and the simplification of calculations. Among the disadvantages are the necessity to relearn measurement units and the expense involved in the changeover. Most respondents think it would take six months to make the conversion, and they feel the areas that would be the most affected are food, clothing, and household equipment.

MARYLAND CONSUMER ASSOCIATION, INC.

At present there is no noticeable increase in metric usage except in the number of foreign automobiles in use. The repair and servicing of foreign automobiles have been somewhat of a problem. Under planned metrication, initial resistance would be encountered, but the decimal feature of the metric system would be an advantage. Cost and confusion for the consumer would be the main disadvantage.

CREDIT UNION NATIONAL ASSOCIATION, INC.

Worldwide metrication will affect consumers as imports from metric countries increase. CUNA's Task Force on Consumer Affairs possibly would consider the issue further should the need arise.

CONSUMERS UNION

The Consumers Union recognizes that the merits of the metric system, while substantial, could only be secured if the energies of interested private and governmental agencies would be enlisted and coordinated to secure its adoption.

ASSOCIATION OF POMONA VALLEY CONSUMERS

Consumers would need proper protection to avoid being taken advantage of during any transition to the metric system.

AMERICAN CONSUMERS ASSOCIATION, INC.

Consumers make no use of the metric system at present. There are no disadvantages from the use of the customary system, and familiarity with the customary system is an advantage. Planned metrication could cause confusion and animosity. Consumers would have to replace numerous items; costs could be uncertain. Changes in the food area would be the most confusing. Clothing could be changed gradually, and leisure time and transportation activities could be easily changed.

VIRGINIA CITIZENS CONSUMER COUNCIL, INC.

The Virginia Citizens Consumer Council endorses metrication in the United States with the understanding that such metrication would be gradual and that a major effort would be made to educate the consumer during the transition period.

Needless to say, people generally object to any changes in the status quo. However, the Council recognizes the need for and the feasibility of metrication.

In 1970, the Virginia Citizens Consumer Council conducted a survey of consumer reaction to adoption of the metric system via its Dial-a-Consumer telephone recording system. One-third of those responding expressed no knowledge of the metric system, while another third felt they were somewhat familiar with it. The remainder said they were very familiar with the metric system.

Planned metrication is preferred over "letting nature take its course." Metrication should be accomplished gradually—at least over a decade—so that the consumer, manufacturer, textbook publisher, etc., could adapt to the new system. Manufacturers should label products and advertise those products using both systems until metrication is complete (i.e., all citizens have a working knowledge of the system). The mass media should be used extensively in educating the public. Consumers should be encouraged to conceptualize the liter, centimeter, etc., not simply memorize equivalents.

VI. EDUCATION

A SUMMARY OF INPUTS

The inputs in this area were obtained with the special assistance of the National Education Association and the American Vocational Association, and covered the impact of metrication in elementary and high schools, in higher education, and on the vocational level.

Experience with metric usage shows that it is easier to teach and learn than the customary system. All educational levels support metrication as an aid to improved efficiency in learning, starting as soon as possible following a short preparation period.

The advantages of metric system usage in education would far outweigh any costs and problems faced in transition. Professional groups see only minor costs for in-service teacher training, and for conversion of textbooks and equipment. The vocational schools foresee opportunities to train and upgrade people for jobs requiring metric competence; they could also introduce consumers to the metric system when the need arises.

Teaching the Metric System

Students in early grades are able to learn the metric system easily, but find little use for it outside the classroom. Students in the upper grades run into interference with their background in customary units, and find it difficult to think in metric terms.

Metric units are already in general use in teaching modern science courses in elementary schools, and for biology, chemistry, and physics courses in high school. In many of these courses, the metric system is used exclusively;

experience shows that the use of two systems with conversion charts is not helpful; total immersion in the metric system is more effective.

The use of metric units is desirable for all educational courses at all levels. Decimals are easier to learn than fractions and lead to increased accuracy. Confusion from multiple names for a quantity in customary units (e.g., inches, feet, and yards for length) is eliminated in the metric system. Some savings in learning time is possible because of metric usage, and it would release time for other learning.

Vocational Education

Contributions from 10 divisions of the American Vocational Association indicate that metric units are already used to some extent in regular instruction in nearly half of the divisions. All agree that a planned metrication program with firm dates for completion would be essential. Except for courses using machine tools, conversion could be completed in 2 to 5 years, and conversion costs would be minor. Trade schools feel that up to 10 years might be needed to hold equipment costs to a minimum. Since vocational courses prepare students for a specific occupation, metric training would have no value until the employer is converting to metric usage.

In addition to training beginners, the vocational schools are also prepared to offer up-grading courses for employees needing training in the use of the metric system on the job. Most adults who come for up-grading would have little or no knowledge of the metric system, and would bring widely varying skills and educational backgrounds. Programmed instruction methods have been developed to teach the adult exactly what is needed without wasting time.

The vocational schools also anticipate an important role in educating consumers as metric products become available. Almost every consumer in the nation has a vocational school within easy driving distance. Trained staff, classroom facilities, and demonstration equipment are already at hand, or could be available by the time they would be needed.

Teacher Education

Metrication would require retraining of teachers prior to the start of the transition. The in-service training needed would take 2 to 5 hours of classroom instruction supplemented by practice and experience in order for the teachers to learn to think in metric terms. Existing in-service training channels could be used, and most school districts have science and mathematics teachers qualified to provide the training. Some resistance to a change is anticipated from older teachers; new teachers entering the field would be proficient in metric usage.

Textbook Replacement

Book publishers would be able to convert textbooks to the metric system with little cost or problem if they have at least 5 years advance notice. Most textbooks are revised every 5 years, and metric units could replace customary units at the time for normal revision. The advantages of a simple, uniform system of units would outweigh any conversion problems.

Individual Inputs

NATIONAL EDUCATION ASSOCIATION

The National Education Association, in 1970, adopted the following resolution:

> *"The National Education Association believes that a carefully planned effort to convert to the metric system is essential to the future of American industrial and technological development and to the evolution of effective world communication. It supports federal legislation that would facilitate such a conversion.*
>
> *"The Association declares that, commencing with the 1971-72 school year, teachers of all grades should teach the metric system as the primary system of weights and measures of the United States."*

At present, elementary school instruction in the metric system is brief and superficial but is gradually improving. A national program of metrication would lead to a simplification of the learning process and some time would be saved. There would be readjustments in texts, training, and equipment. Costs and problems would be minimal if spread over a reasonable time, perhaps 10 years. Of course, a reasonable lead time for planning would be needed. There would be no dollar savings; time would instead be released for other learning experiences.

THE AMERICAN INDUSTRIAL ARTS ASSOCIATION

Industrial arts reflects the conditions existing in industry. The metric system is taught in 40 to 50 percent of the courses where measurement is required. Any conversion in industrial arts must follow a shift by industry. Massive in-service training would be needed. Tools and machines would be a problem and a 10-year phase out program would reduce costs. Eventually there would be a saving in time and energy.

COUNCIL FOR EXCEPTIONAL CHILDREN

Contrary to present practices in "normal" education, most exceptional children (except the gifted and, only recently, the deaf) are not introduced to the metric system at all. Teaching a dual system (customary and metric) would be confusing, even detrimental, for exceptional children; they need a system related to what they encounter in real life. There is substantial reason to believe that they could learn and relate to the metric system much more easily than to the English system of measurement. School and nonschool strategies to implement this transition are known and rather easily utilized by teachers and parents.

NATIONAL ASSOCIATION OF SECONDARY SCHOOL PRINCIPALS

Most of the 200 schools surveyed indicate the metric system is presently being taught, mostly in chemistry, physics, mathematics, general science and physical science. Over the past 10 years, the use of the metric system has been increasing.

If the United States should adopt the metric system, in-service training, especially for teachers outside of math and science, would be needed. The cost of textbooks would be minimized if spread over a 5- to 10-year period. It would be worth the effort since the metric system is a more logical system and easier to learn.

NATIONAL COUNCIL OF TEACHERS OF ENGLISH

Metrication would have no significant effects on English teaching.

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

The National Council of Teachers of Mathematics, in 1969, adopted the following resolution:

> *"Be it resolved, That the National Council of Teachers of Mathematics encourages the universal adoption of the metric system of measure."*

At present, the metric system appears briefly in all arithmetic series and the trend has been towards an increase in use. Nevertheless, most students don't think in metric terms and teachers are not adequately trained.

If the metric system were adopted following a planned program over a period of 5 or 10 years, teachers could be retrained through existing channels, but more money for in-service education may be necessary during the transition period. However, the revision of textbooks, either at the elementary or secondary level, would cause no major additional cost. For a period of years more time would have to be devoted to the teaching of measurement, but in the long run metrication would promote efficiency in learning mathematics.

NATIONAL SCIENCE TEACHERS ASSOCIATION

The National Science Teachers Association, in 1969, adopted the following resolution:

> *"The Association strongly urges that the metric system and its language be incorporated as an integral part of the education of children at all levels of their schooling. We believe this goal can best be realized within the context of a complete conversion to the metric system in all sectors of national life."*

Metric units have been used for decades in science teaching and during the past decade there has been a marked trend toward their exclusive use.

Although this trend has been more pronounced at the secondary level, it has also been noticeable at the elementary school level. The main problem encountered with such usage is that the metric system does not relate to life outside the science classroom.

Under a conversion to the metric system, any short-term disadvantages would be far outweighed by long-term advantages. Costs would be minimal over a 10-year period.

NEA DIVISION OF ADULT EDUCATION SERVICE

The National Education Association Resolution C-16 states that "all grades should teach the metric system." The Division of Adult Education Service recommends that adult education courses be used to bring about rapid and effective conversion. It strongly supports a planned program of conversion. Its usage may be helpful to millions of adults who do not know basic computational skills.

AMERICAN CHEMICAL SOCIETY

In 1966 and in 1968 the ACS Board of Directors voted "that the American Chemical Society endorse the adoption of the metric system in the United States."

At present the metric system is used in practically all (greater than 90%) chemistry classes and laboratory work. Chemical engineering programs use customary units but the trend is toward the use of metric units. ACS publications use metric units in scientific journals; but both metric and customary units can be used in applied journals.

AMERICAN GEOLOGICAL INSTITUTE

There is little metric usage in both secondary schools and colleges, but the trend is towards increased metric usage at both levels. If the metric system were universally adopted, advantages would far outweigh disadvantages. Announced deadlines would be best. It is estimated that nearly universal utilization of the metric system in schools could be attained within 5 years.

Further research on the effects of early metrication on the geological profession and on the teaching of earth and/or geological sciences should be carried out.

THE AMERICAN INSTITUTE OF PHYSICS

Modern physics textbooks use the metric system almost exclusively and almost all laboratory equipment is calibrated in metric units. Full adoption of the metric system is desired and would present no serious difficulties or disruptions in any of the several aspects of physics education.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

At present, the metric system is used in the basic sciences; but the customary system is used in engineering education. If the United States should convert to the metric system, it would take between 5 and 10 years to make a complete change; in higher education it would probably be necessary to be bilingual for several decades. If a change were planned, the metric system must be taught as the *primary* language as soon as possible. Physical changes required would include gradual changes in reference tables, charts, diagrams, and experimental laboratory equipment, but these could be accomplished readily in a decade.

ASSOCIATION OF AMERICAN LAW SCHOOLS

Metrication would affect law teachers, law students, and the legal profession in indirect ways in the courses which are taught and no specific effects are foreseen. The only foreseeable impact of metrication would be the government statutes that would need to be revised.

THE GEOLOGICAL SOCIETY OF AMERICA

Currently geology is a multidiscipline profession and uses both the customary and the metric systems. However, the Geological Society of America is in favor of the ultimate adoption of the metric system and its policy statement addressed to contributors to its periodicals and book publications is that "the metric system is preferred."

MATHEMATICAL ASSOCIATION OF AMERICA

Mathematics courses in the secondary schools teach systems of measurement, but higher level courses are dependent on and use no particular system. The use of the metric system in secondary school texts has increased as it has increased in use throughout the world. Textbooks, reference works and research reports use metric units. The only difficulty with its usage is that students visualize more readily in English units.

Since metric usage is common, a general conversion would not result in curriculum changes. Cost would be negligible and the advantages would be overwhelming. Therefore, a complete conversion to the metric system within education at all levels in the United States as soon as possible is strongly recommended.

NATIONAL ASSOCIATION OF COLLEGES AND TEACHERS OF AGRICULTURE

The National Association of Colleges and Teachers of Agriculture foresees no major curriculum changes in subject matter if metrication were to occur. It would cause changes in some laboratory equipment and shop equipment, the revision of textbooks and visual aids and some teacher retraining. There would be no time saved initially because both systems would continue to be taught, possibly long beyond the end of any transition period.

NATIONAL COUNCIL FOR GEOGRAPHIC EDUCATION

The primary measurement units used in geography courses are customary units, although the field lends itself well toward increasing metric usage. The government should lead and coordinate any conversion. The training of teachers would involve some difficulties, but the savings in time should be substantial.

SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS

Although the Society for Industrial and Applied Mathematics has taken no official position, it is generally considered among members that metrication is desirable, inevitable, and overdue.

American Vocational Association

AGRICULTURAL EDUCATION

Metric usage is limited to certain areas such as science and chemistry related to agriculture. The metric system would be easier to use and would provide a more uniform standard of weights and measures. However, any conversion must be well planned and involve all areas of education and the agricultural industry. The major cost impact would be for re-equipping laboratories.

BUSINESS EDUCATION

At present customary units are used. Conversion would merely involve temporarily supplying teachers with supplementary manuals, a brief retraining of typewriting teachers and a more extensive retraining for business mathematics teachers.

DISTRIBUTIVE EDUCATION

The customary system is used exclusively in distributive (marketing) education and there are no plans to introduce the metric system. Complete adoption of the metric system would reduce the amount of time spent in classes teaching weights and measures. There would be no special problem related to conversion of textbooks if 5 years were allowed. It is likely that distributive education could perform an important function in implementing the transition.

GUIDANCE EDUCATION

At present there are no problems related to increasing metric usage except that some learning problems confronting counselors may be associated with students having to work with two systems of measurement. Instruction received by counselors would not need to be altered if the country were to change to the metric system. One long-range advantage would be less confusion to the students.

HEALTH OCCUPATIONS

Currently in educational programs preparing supportive level health workers, the metric system is most commonly used, but the customary and apothecary systems are also used. Confusion and conversion problems exist, and this has implications for patient welfare due to mistakes. Adoption of the metric system would not lead to major changes in present curricula, except to reduce the need for conversions which must now be taught.

HOME ECONOMICS EDUCATION

At present the customary system is used exclusively. Planned metrication would take a strong concerted effort coupled with a legislative mandate. The continued use of customary recipes, patterns, and accompanying directions would be a disadvantage for almost a generation.

INDUSTRIAL ARTS EDUCATION

At present, about 35 percent of the courses in industrial arts use the metric system. However, extensive variation is found in various areas of instruction; for example: all of the electronics courses use metric measures. Planned metrication would cause some financial problems, especially in metal working and auto repair instruction. It would probably take 10 years to change all labs, and instructional materials would require 5 years to be replaced. A decision to change in this field would not be accepted without criticism, but comments favorable to a change outnumber negative ones 4 to 1.

NEW AND RELATED SERVICES

Four essentials for planned metrication in manpower training programs for adults are:

(1) The factors which make each adult learner unique must be understood.
(2) Appropriate adult-oriented programmed instructional material relevant to metric usage within each occupation must be developed.
(3) These materials must be presented via an individualized training system.
(4) Adequate staff training must be provided.

The cost of metrication would be reduced if these four essentials were provided for in adult education.

TECHNICAL EDUCATION

At present metric measurements are used in basic science courses, data collection, and problem solving. The customary system is used in drafting, machine-oriented courses, and architectural programs. Planned metrication could be easily undertaken because teachers are familiar with the metric system. Some equipment conversion would be required and 5 years would be sufficient to revise handbooks, standards, and tables.

TRADE AND INDUSTRIAL EDUCATION

At present unit usage is primarily customary, but metric usage is now starting in the training of auto mechanics. Under a planned conversion to the metric system, the vocational education program would adjust to the demands of each of the industries. Occupational fields such as cosmetology, dry cleaning, refrigeration, and many others would require some adjustments to conform to conversion. The supplementary part-time program in the schools could assist the present employees to make the necessary adjustments while continuing to be employed.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The Commission on Science Education of the American Association for the Advancement of Science has developed a science program for children in grades kindergarten through six that uses only metric units for all measurements.

In general, children learn the metric system easily. The natural link between the metric system and our counting system simplifies the learning of arithmetic skills and facilitates the learning of decimal notation. Slower children learn the metric system more easily than the customary system. Upper elementary children previously exposed to customary units tend to compare these units with metric units. Teachers generally favor metric measures in the science curriculum though they themselves have some difficulty thinking metric.

BIOLOGICAL SCIENCES CURRICULUM STUDY

The Biological Sciences Curriculum Study encompases materials developed for grades 9 through graduate school with emphasis at the 10th grade level. All materials use the metric system exclusively. Experience has shown that the metric system is easier for the students to use than the customary system. Students take to it readily, comprehend it easily, and use it adequately. Unfortunately students have to use two different systems – metric in the classroom and customary in daily life. This is a handicap and burden.

If there were a planned program of metrication, a major source of difficulty would not be in teaching students but in changing teachers. Nevertheless, teacher training should not be difficult. Fortunately, little change would be needed in the sciences area since the metric system is already used extensively there.

EDUCATION DEVELOPMENT CENTER

The Education Development Center has experience in the use of the metric system in three completed curriculum projects for junior and senior high school science students, and one 4-year college curriculum in science and mathematics for future physics and chemistry teachers that is currently under development.

Metric units are used almost universally, and in feedback from the teachers there has been no suggestion that the metric system is difficult for the students to learn or hindered the understanding of materials.

The educators at EDC feel that in physics and chemistry the use of the metric system is indispensable because it saves time, does not obscure basic scientific principles and is not difficult to learn. They would like to see all school science texts use metric units.

INTERMEDIATE SCIENCE CURRICULUM STUDY

The Intermediate Science Curriculum Study is a large scale science instructional project for grades 7-9 with metric units used exclusively.

Tests on pupils entering the program early in grade 7 show that many students at this level cannot handle the metric system efficiently today. However, the majority of students using the ISCS math in grades 7-9 learn to use the metric system expeditiously and accurately. This experience leads the developers of the Study to feel confident that such usage of metric units could be easily taught in schools.

PROJECT QPS (QUANTITATIVE PHYSICAL SCIENCE)

Project QPS is devised for students age 14 (9th grade) and older. It starts with experiments and then uses textbooks. Learning and contrasting more than one measurement system is useful for instruction of these students, so QPS systematizes three measurement systems: mks, cgs, and British Engineering.

QUANTITATIVE APPROACH IN ELEMENTARY SCHOOL SCIENCE

The Quantitative Approach in Elementary School Science has developed a curriculum for grades 1-6, with the metric system used exclusively.

Experience with metric usage has shown that its several advantages include: decimal divisions are inherently easier to learn; math lessons on place values and decimal arithmetic are more tangible; and concepts about density and force are less confusing with metric units. Its only disadvantage seems to be that most teachers are frightened by it. They take to it naturally once they try it. There are no difficulties as far as students are concerned; they take to the metric system naturally, too.

AMERICAN LIBRARY ASSOCIATION

Librarians have used the metric system to measure books and catalog cards since the late nineteenth century. The use of the metric system would correct a nearly 100-year-old inconvenience in, for example, using catalog card cabinets.

The libraries would be inconvenienced by the need to replace the general reference tools such as cookbooks, atlases, formularies, data books, tables, and various specifications. This represents not only a significant number of items in a scientific collection but also represents many expensive items in a public or school collection.

Libraries would have to collect—and in fact are doing so now—additional materials dealing with conversion from the present systems of measurement to the metric system. The Department of Commerce and other agencies could take advantage of this already existing information outlet to provide instructional materials to the general public.

ASSOCIATION OF AMERICAN PUBLISHERS

The main concern of publishers related to conversion would be to have as much lead time as possible to handle necessary changes. A transition period of 5 years would make a cost impact minimal.

The greatest editorial changes would be in elementary and high school math and science textbooks and teaching aids. In addition the books in the medical and scientific instructional fields would require considerable adaptation. Fewer changes would be needed in college textbooks and adult education course texts. Substantial changes in encyclopedias would also be required.

ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY

A majority of the members of the Association for Educational Communications and Technology favor prompt commitment towards conversion.

If the use of the metric system were increased, mediated self-instructional (audio-visual) materials seem ideally suited for its presentation when instructors lack understanding of the content. Even when they know the metric system, such materials could assist in presentations. Mass media, such as television, would be the only way to reach those no longer in school.

VII. CONSTRUCTION

A SUMMARY OF INPUTS

The construction inputs were obtained with the special assistance of the Construction Affairs Committee of the Chamber of Commerce of the United States. Inputs were received from 26 construction related groups.

A majority of those groups (ten) expressing an opinion feel that metrication is inevitable and/or desirable. Only two groups are opposed to metrication; 14 either express no opinion or state the use of measurement systems does not affect their activities.

Almost all groups expressing an opinion on a preferred method of conversion indicate that any such program should be carried out only under a nationally coordinated program. Some want a mandatory program and many suggest that a Federal agency take over responsibility for coordination. A 10-year transition time is commonly preferred, with the first 5 years used in converting codes, standards, and catalogs.

Cost and Benefits of Conversion

There is some resistance to change, usually based on estimates of transition costs with no foreseeable benefits. Many feel that conversion costs would be moderate, and once behind them the simplicity of metric usage would bring continuing savings, opportunities for more modular construction, and increased exports.

Transition costs would be less than for manufacturing industries since most equipment changes could be made by adjustments or by normal maintenance in 1 or 2 years. Some added costs would be anticipated during transition from the necessary accelerated revision of codes, standards, and design tables; added inventories causing some mix-ups at the job site; and some worker inefficiency while adjusting to metric sizes.

Training would not be a serious problem for the construction industry. The changeover would require new thinking, and "unlearning" of long-established relationships. Vocational and apprentice schools would have to change instruction to use metric units, but young workers entering the field with metric training would find measurements and calculations easier to make.

Some problems would be faced, during and after conversion, in repairing older structures built to customary standards. Dual inventories would have to be maintained on some materials for many years, and a variety of adapters would have to be stocked.

Modular Construction

More than half of the industry reports comment on the opportunity offered by metrication to advance the concept of modular construction and achieve important cost savings. Unified codes could reduce the number of sizes and simplify the fitting of components together on the job. Uniformity would reduce intermixing and on-site cutting, and save construction time. In addition, the use of metric modules would provide more opportunities for exchange of materials and test data abroad.

Metric standards for wallboard and plywood panels are only slightly smaller than our 4 by 8 foot standard. Producers could change over to metric sizes by merely adjusting machinery. Metric cement block dimensions are close to present U.S. sizes, with about a 3/8 inch difference in thickness. Since molds have a relatively short life, conversion of the machinery could take place during normal replacement. A major concern for all such building products manufacturers during any conversion process would be the need to continue to supply products made to inch standards at the same time as new metric-sized products are being produced.

Other Items

The conversion of land title descriptions to metric units is suggested only on a "go forward" basis, at the time property changes hands. No useful purpose would be served by converting existing records. Maps could be converted at the time of normal up-dating.

The experience of the construction industry in England, which is taking a leading role in metrication there, is cited by several trade associations as a good guide to the procedures which should be followed. All building construction in England will become metric by 1972, 7 years after the start of their metrication program.

Inputs from Individual Groups

AIR-CONDITIONING AND REFRIGERATION INSTITUTE

The report is based on a survey of member firms. It indicates that there is little or no motivation or demand either for making the change to the metric system or for planning for possible metrication in the future.

Consideration of the replies results in a consensus of ACRI's General Standards Committee to the effect that while there appears to be no motivation for metrication at this time, the industry would cooperate in any nationally planned move for metrication, provided that a reasonable time period were provided – not less than 10 years.

AMERICAN CONCRETE INSTITUTE

When job mixing of concrete was replaced by ready-mixed concrete, the choice of units had little implication. But the current increase in precast construction is leading to two sets of standards, one in the United States and another abroad. Also, U.S. standards for reinforcing bars are not compatible with European practice.

To prepare the industry for eventual metrication, the American Concrete Institute now requires the use of metric units in all its publications, with customary units permitted. The new British building code includes a new metric standard for reinforcing bar sizes intended to be somewhat compatible with U.S. standards.

The concrete industry is presently going through a period of rapid change in practices and standards, and this would be an opportune time to convert to the metric system so that a separate conversion at a later date and at a greater cost, could be avoided.

AMERICAN INSTITUTE OF ARCHITECTS

The Board of Directors of the American Institute of Architects, in April 1970, passed the following resolution:

> *"Resolved, That the Board of Directors of the American Institute of Architects urges the completion of studies authorized by Public Law 90-472, particularly as these studies relate to the construction industry, and further urges that the metric system be adopted as the national standard of weights and measures in the United States of America."*

Generally, architectural projects which are to be constructed in the United States are designed and constructed using the customary measurement system. Projects designed for construction out of the U.S. are usually designed using the system in general use at the location of their construction.

Any conversion should take place in a planned 10-year period because under that program the conversion would be more orderly, take less time, and allow the easier incorporation of a standardized dimensional framework into the product and dimensional standards of the United States.

AMERICAN INSTITUTE OF PLANNERS

With no planned program for metrication, the greatest problem would be comparability of data. For example, planners use data, such as miles, tons, and gallons, from many Federal agencies. Changing to the metric system would require the use of conversion tables and careful descriptions of data. Without Federal Government coordination and widespread cooperation this conversion could be a tremendous undertaking. However, under a nationally coordinated program, planners would be affected no more than the general population.

AMERICAN LAND TITLE ASSOCIATION

The report of the American Land Title Association is based on a survey of association members. The survey basically indicates that while some of the members anticipate advantages, such as the efficiency and uniformity that might be realized if metrication could be accomplished, the consensus is that conversion of land title records is unnecessary since land is neither exported nor imported. Further, the consensus seems to be that such a change would be difficult, confusing, and expensive to the public as well as to title companies and would contribute to greater error in title evidencing and insuring.

The complexity of converting the huge number of public records now on file in numerous offices should be carefully considered if land title metrication were contemplated. Thought should be given to the possibility of converting land title records only on a go-forward basis if metrication comes; changing back-dated public record information to metric units in both public offices and title company files would mean very high cost with little apparent benefit.

In 1970, the ALTA Board of Governors adopted a resolution which reads in part as follows:

> *"Whereas, virtually all major industrial countries in this world have converted to the metric system: Now, therefore, be it resolved that the American Land Title Association sees no advantage in converting land titles to the metric system; nevertheless, the Association will cooperate in any decision made by the Congress to convert to the metric system."*

AMERICAN PLYWOOD ASSOCIATION

The softwood plywood industry uses the customary system of weights and measures. At this time, it does not appear there is a significant possibility the industry would voluntarily changeover to the metric system unless all industry changed over at the direction of the Federal Government.

It appears the logical way to carry out a program of planned metrication in the plywood industry and in the United States would be to establish timetables for a fixed time period of perhaps 10 years, or more, with sufficient lead time established for coordination between related industries prior to work beginning on standards, construction modules, etc.

It seems important that industries be encouraged to stay as close to present sizes and modules as possible to minimize the impact of the change. In view of the popular 4 by 8 foot panel size and the capacity of existing equipment, a maximum new panel size equivalent to 49 by 98 inches would be feasible. Mere conversion to the metric language does not seem to offer too great a problem, but any radical changes in physical sizes could be chaotic because expensive equipment would become obsolete.

The greatest problem involved in metrication would probably be that of coordination between industries that are inter-related and that need to establish size standards that are compatible with each other.

AMERICAN ROAD BUILDERS' ASSOCIATION

The report is based upon a survey of selected member firms.

In general the survey indicates that there would be some advantages and some problems for the highway and airport construction industry in a national changeover to the metric system of measurement. In spite of the potential problems, the industry in general favors a changeover in the national interest of a more uniform and logical system of measurement.

Most members feel that a changeover is inevitable and desirable but that the change would require close coordination among different industries. This close coordination could only be affected by the Federal Government in a planned program of education, encouragement, and perhaps financial assistance.

Some segments of the highway industry could change rather quickly, others more slowly. The timing of a change must be coordinated to follow the logical sequence of operations beginning with planning and design and continuing through construction, testing, and maintenance. The change of engineering standards is often a time consuming process, and these changes must be coordinated with the industries involved.

AMERICAN SOCIETY OF CIVIL ENGINEERS

This report is based on the work of a special Metrication Committee of the American Society of Civil Engineers.

The Society has been on record since 1876 as favoring a conversion to the metric system. The many ASCE divisions have different opinions, but the majority seem to feel that conversion would present problems, but none that would be insurmountable, and, in fact, may lead to certain efficiencies.

THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA THE NATIONAL CONSTRUCTORS ASSOCIATION

Based on experience reported by the British Metrication Board in 1970 relative to Great Britian's conversion to the metric system, and on the opinion of members of the associations, no increases in cost or difficulties due to conversion in the construction industry are foreseen, providing:

(1) That the conversion is orderly, planned and gradual in its effects; and

(2) That simultaneously with the conversion, the standards, codes and specifications which now prevail are modified to conform to the new units of measurement, and that nationally recognized bodies are urged to standardize the results of their efforts where possible and that local governmental bodies be encouraged to adopt model or regional codes.

BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL

In this country, the customary system of measurement is used exclusively in building code enforcement. Since the customary system of measurement has served the necessary purposes satisfactorily and the construction and related industries use the customary system, the motives for instigating any change are based on matters not directly related to, but certainly concerning, this industry.

The members of BOCA who have expressed an opinion on this subject, favor a change to the metric system because:

> *A common system of measurement throughout the world would improve international trade and commerce and facilitate the exchange of materials, building techniques, and systems between nations.*
>
> *A common system of measurement is imperative to share technological innovations between nations.*
>
> *The metric system is convenient for engineering computations.*
>
> *Building codes could be universally interpreted and adopted.*

BOCA feels the possibility of complete metrication is negligible, unless a mandatory conversion process is adopted. Therefore, the members of the Building Officials and Code Administrators International strongly recommend that the Secretary of Commerce urge the Congress to take immediate action toward implementing a 20-year planned metrication program for the United States.

CALIFORNIA REDWOOD ASSOCIATION

The redwood industry would prefer a soft (i.e. language only) conversion to a hard (i.e. changes in size) one. Regardless of what occurs, however, it appears that there would be no insurmountable problems for the redwood industry due to metrication.

CONSULTING ENGINEERS COUNCIL

A major concern of the Consulting Engineers Council related to metrication is the increase in expenses that could be incurred in a transition period due to unfamiliarity with the metric system. This possible increase would need careful monitoring especially as to its effects on small engineering concerns, since a 5 percent cost increase could place severe burdens on such operations.

It is conceded that the metric system, as a more coherent system, would be more efficient. Also, engineers, with their specialized training, would be able to adapt more rapidly than others.

GYPSUM DRYWALL CONTRACTORS INTERNATIONAL

It is difficult to see beneficial results from metrication. Under planned metrication, problems resulting from new sizes could involve changes in building codes, building design, structural values, fire resistive requirements, sound transmission class ratings, architectural drawings and specifications, conversion of board production line speeds, drying kilns, possible changes in formulation, and many others. Until such time as architectural drawings and specifications, building codes, engineering standards, structural values, and other regulatory requirements are revised and reflected in metric units, the magnitude of any change to be encountered by the drywall industry in converting to the metric system would be difficult to ascertain.

ILLUMINATING ENGINEERING SOCIETY

Customary units of measure are used in the lighting industry, such as the foot, footcandle, and footlambert. However, in all transactions of the Society, metric units are shown parenthetically following customary units. Metric units are used in the industry when related to export or foreign consulting.

Although most of the world now uses metric units, it still uses the foot as a module measure for many lighting products, such as fluorescent lamps. This may not change. If a planned program for metrication were to begin it would be a greater problem to educate the consumers and designers than to redesign parts or products.

INSTITUTE FOR MUNICIPAL ENGINEERING, AMERICAN PUBLIC WORKS ASSOCIATION

If the municipal engineer and public works official is to fulfill his role in protecting and enhancing the human environment, he must utilize the latest available technological innovations both at home and abroad. The adoption of the metric system by almost all nations of the world clearly establishes it as the universal system of measurement. The benefit of technical exchanges on public works matters is greatly diminished by our failure to utilize and be conversant with this universal system.

Furthermore, municipal engineers and public works officials have expressed a general desire to change to the metric system. This is due primarily to its economy in performing engineering calculations and its increasing acceptance as a universal system of measurement. The use of the metric system for solving many engineering and public works problems requires one-tenth the time for calculation as compared to the customary system.

A planned metrication program would add approximately 5 percent to the cost of all public works operations during the conversion period. The technical benefits and long run economies of this effort, however, would greatly outweigh the conversion costs.

INTERNATIONAL ASSOCIATION OF WALL AND CEILING CONTRACTORS

An informal survey of the International Association of Wall and Ceiling Contractors' membership reveals that no members are opposed to a change to the metric system. If the change were done on a gradual basis—and as long as the entire construction industry changes—there should be no problems of major consequence in this segment of the industry.

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

The use of the metric system in present activities is limited in a very minor way to the research program. Any changes in weights or measurement nomenclature in the enforcement field would be dictated by the needs of the material and construction industries. In other words, if the metric system is universally adopted in the production and design of lumber, steel, concrete, masonry and aluminum, model code groups would convert to the new system without difficulty. However, it is possible that adverse effects would result from evolutionary metrication not having the benefit of a coordinated program between Federal, state, and local governments and the construction industry.

It is likely that the majority of the members would initially resist conversion to the metric system since the field personnel are nontechnical. However, since the metric system is more efficient and more practical, the membership would eventually subscribe to the change following an adequate educational program by ICBO.

MOBILE HOME MANUFACTURERS ASSOCIATION

The Mobile Home Manufacturers Association as a group has no opinions or position to offer. Present unit usage is predominantly customary, but there seems to be little doubt that the industry would be able to accommodate any conversion without serious consequences.

NATIONAL ASSOCIATION OF HOME BUILDERS

This report is based upon a survey of a representative sample of the National Association of Home Builders' membership.

Converting to the metric system would create problems in the repair and remodeling of millions of homes and apartments already built in this country. These buildings, dimensioned in inches and feet, would need repairs long after completion of the conversion to the metric system. The intent of metrication should be to arrive at workable and easily understandable measurements.

Past experience in attempting to introduce modular coordination has shown that unless there is a coordinated effort, with some positive means of encouragement, an evolutionary process will probably be unsuccessful. Any system of planned metrication must take into consideration the fact that the construction industry is highly complex and over the years has developed highly efficient and economical methods for utilization of materials.

NATIONAL CONCRETE MASONRY ASSOCIATION

The concrete block industry almost exclusively utilizes the "modular coordination" concept, and the presently used module is based on the customary system. Conversion to a similar metric module would be possible but would cause two serious problems:

(1) Production equipment changes would be costly

(2) Modular customary blocks and modular metric blocks cannot be intermixed in the same job without destroying both the modular concept and the beauty of the wall.

Since concrete blocks are made and sold strictly on a local basis with no shipment in the international market, the concrete block industry sees no benefit resulting from metrication.

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

The report is based on a survey of member firms. The survey reveals that at present the customary system is primarily used, except that electrical units are metric. However, as more firms seek to go international, the need to "think metric" becomes more imperative. Increasing imports of materials is presently causing problems for domestic operators, including on-site personnel.

The overwhelming majority of the Association's members approve the idea of converting and express a sense of urgency that it be undertaken as soon as possible, following a carefully planned program.

The majority recommends the conversion be concurrent in architectural design and electrical materials manufacture and that the government take the lead in fostering and encouraging conversion on all fronts more or less concurrently.

NATIONAL FOREST PRODUCTS ASSOCIATION

It is unrealistic to think that the construction and building materials industries would permit a trend toward metrication, either voluntary or stimulated, to proceed without coordination. Such coordination should involve architectural planning, modular coordination and engineering design as well as product development and use.

The attitudes encountered most frequently in the forest products industry on the subject of metrication seem to be: (1) that the trend is an unavoidable one; (2) that its benefits to most segments of the industry have not been fully explained or understood; and (3) that the total cost over the period of conversion may be difficult to justify in terms of direct benefits. Reaction ranges from enthusiasm through cautious optimism to concern for cost and disruption of production and marketing practices.

It is generally believed that simple conversion of present measurement units to the metric system at the product level could be accomplished with minimal adjustment of equipment and training of production personnel. Volumetric determinations of log yield and conversion of land measurements to the metric system, however, are thought to be significant constraints where a dual system may be required for some time.

With respect to lumber use in building construction, the extent to which benefits of metric conversion could be translated into simplification of the building process and demonstrable construction economies would be a major factor in determining the pace of metrication and degree to which coordination of the effort would be encouraged and supported.

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

If metrication is undertaken a planned program must be employed with a time table that would enable the contractors to initiate educational programming for their work forces. The major problem in the industry would be training journeymen and apprentices who are presently doing layout work on sheet materials to form three-dimensional products. This is the only trade in the construction industry that still fabricates that which it installs and this requires the use of an extensive shop facility for fabrication purposes.

Perhaps the item of greatest concern, however, would be the administrative ceiling on overhead allowed on government construction projects. Such restrictions should be increased to allow for added costs due to inefficiencies during conversion.

STRUCTURAL CLAY PRODUCTS INSTITUTE

The report is based on a questionnaire survey of members.

The attitude of the brick industry in the United States toward metrication can be described, at best, as "lukewarm." While it accepts the fact that the metric system is, basically, a more logical and simpler system of measurement than the one we have been using for centuries, it cannot see any economic benefits that would result from converting. It does see, however, a certain amount of confusion and expense during a transition period.

On the other hand, it is also cognizant of the fact that the United States will, no doubt, not let itself become an isolated nonmetric island in a metric world. Therefore, if the increased use of the metric system is inevitable in the U.S., the brick industry urges that it be accomplished under a nationally coordinated and planned program with a fixed time period of sufficient duration to permit everyone involved to accomplish metrication with a minimum of confusion and cost.

It would be hoped that a planned program could result in an industry agreement on a fewer number of what would be considered standard metric brick sizes. It could also result in agreement on some new and more optimum sizes, necessitating some retooling in the industry, with its attendant expense.

VIII. ENGINEERING-RELATED INDUSTRY

A SUMMARY OF INPUTS

Many of the engineering-related industry inputs were received at the first conference which was held on the campus of the Deerfield Academy, Deerfield, Massachusetts, arranged in collaboration with the Engineering Foundation. Co-chairmen were Roy Trowbridge of General Motors Corporation, William Burton of Ford Motor Company, and Jeffrey Odom of the National Bureau of Standards. A total of 41 inputs were received.

A majority of the reports either favor metrication or feel that it is inevitable, although many reports indicate concern about the costs or other problems that might accompany metrication. If metrication comes, a majority of the reports indicate support for a nationally coordinated plan with 3 to 5 years preparation and 8 to 12 years for completion. Some governmental action would be necessary to permit the close industrial collaboration essential for producers, customers, and suppliers to work together in setting priorities and time schedules.

Disadvantages

The major disadvantage of conversion cited in the inputs is the cost of converting production equipment. This could be very high unless replacement could be made at the time of normal wearout or obsolescence. Other problems could include retraining operators, inspectors, and engineers which would be costly.

Other one-time costs would include the revision of drawings, standards, repair manuals, and computer programs. Some production loss during transition could be expected. Also, added inventories of materials and repair parts would have to be maintained for many years.

Advantages

Some advantages are anticipated in increasing metric usage with respect to the in-house design of products and production equipment. These would include opportunities presented for improvement in design and the elimination of unnecessary varieties. Savings should also occur in engineering, production and accounting operations from reduced computation time and fewer errors.

Other advantages relate to the benefits of worldwide use of a single system. These include a more complete system of modules with worldwide interchangeability and an improved U.S. position in international standards development. There would also be greater acceptance for U.S. products in export markets, particularly in developing countries. Of course, foreign suppliers would find increased acceptance here for their products.

Technical Societies Positions

Policy statements from nearly all of the technical societies reflect a consensus that the metric system has important advantages over customary units and that increasing worldwide use will hasten adoption here. The societies accept the responsibility for making their members aware of these world trends and educating them to metric usage. All societies (eleven) report some metric usage by their members, and many of the technical organizations are already using both customary and metric units in their standards and publications.

Five of the societies feel metrication is inevitable and/or desirable; six offer no comment. None indicate opposition to conversion.

Trade Associations Positions

Statements by the trade associations include a wide range of views on metrication. Positions range from hard opposition to general resistance to a change, to the feeling of the need to change due to the changing world situation. The majority, however, feel metrication is desirable and/or inevitable, and that it should be brought about by a voluntary nationally coordinated program. In actuality, 17 associations – many expressing concern over the problems of conversion – feel metrication is inevitable and/or desirable, five see no need or desire to make a change, and eight have no opinion. Only one association indicates a preference for metrication with no national program; 16 favor planned metrication, and 13 indicate no opinion.

Time estimated as required to complete metrication, on the average, is a little under 10 years. Materials manufacturers and some industries with products that have a relatively short life cycle feel that conversion could be completed in 5 to 8 years, but 10 years is the time most often cited. Many reports mention the need for a period of time for preparation before the start of actual conversion. Nearly all emphasize that minimum conversion costs would require a carefully prepared plan, national in scope.

Inputs from Individual Groups

THE ALUMINUM ASSOCIATION

The report is based upon a survey of member firms with 55 of 69 firms participating.

The results are as follows:

22 percent currently use the metric system
38 percent see advantages in metrication
65 percent anticipate major problems in adopting the metric system
75 percent want a nationally planned program
81 percent favor eventual adoption

Problems likely to be faced in converting to the metric system would include: education and training, conversion of documents and computers, replacement of instruments, operation with dual systems during conversion, errors and confusion, and early obsolesence of equipment.

There is a consensus favoring eventual adoption of the metric system as a more exact system, easier to use and less subject to error once the transition is made. Of those favoring a planned program, 60 percent consider 10 years an optimum period for conversion.

THE AMERICAN BUREAU OF SHIPPING

The American Bureau of Shipping is an organization that promulgates "Rules" with minimum standards for ship's structure, propulsion machinery, electrical plant, piping systems, and materials. It has representatives in 93 countries covering the world's principal ports.

There is a terminology peculiar to shipbuilding which is derived from the customary inch and pound units of measurement but has meaning only to people engaged in shipbuilding. With the growth of overseas shipbuilding and with over 80 percent of the Bureau's new construction business in countries using metric units, the Rules were published in both metric and customary units in 1967, with metric units favored by placing them ahead of the customary unit equivalents which were enclosed within parentheses.

AMERICAN CONCRETE INSTITUTE

When job mixing of concrete was replaced by ready-mixed concrete, the choice of units had little implication. But the current increase in precast construction is leading to two sets of standards, one in the United States and another abroad. Also, U.S. standards for reinforcing bars are not compatible with European practice.

To prepare the industry for eventual metrication the American Concrete Institute now requires the use of metric units in all its publications, with customary units permitted. The new British building code includes a new metric standard for reinforcing bar sizes intended to be somewhat compatible with U.S. standards.

The concrete industry is presently going through a period of rapid change in practices and standards, and this would be an opportune time to convert so a separate conversion, at greater cost, would be avoided later on.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The official position of the American Institute of Chemical Engineers, adopted in 1965, is that the U.S. should convert to the metric system on a time schedule paralleling British metrication. To date, little has been done to implement this position.

AIChE publications use whatever units are common for the subject or industry, and there has been no significant change in this practice in recent years. A change to metric units in publications on an experimental basis is being considered, and the U.S. Metric Study may well lead AIChE to re-examine the issue.

A change to the metric system would bring a cost penalty for a year or two, but once the initial problems are overcome AIChE sees advantages in improved communications. Many useful numbers used in everyday engineering practice would be lost, new ones would have to be learned, and there would be costs in revising publications.

Chemical engineers are accustomed to working with different systems of units, and making conversions back and forth. A number of chemical engineers were asked about converting to the metric system, and everyone said "let's get at it."

If metrication were adopted, it should proceed on a fixed time schedule to limit the transition period. Steps should be taken to minimize the mushrooming of variations in units promoted by some industries and trade groups.

AMERICAN INSTITUTE OF MINING, METALLURGICAL, AND PETROLEUM ENGINEERS

The American Institute of Mining, Metallurgical, and Petroleum Engineers is a diverse group of three separate societies with about 50,000 members. The Board of Directors, made up of the officers of the three societies, adopted a statement in 1970 supporting adoption of the metric (SI) system of measurement on a national basis.

AMERICAN IRON AND STEEL INSTITUTE

This information was developed by the Metric System Study Group of the American Iron and Steel Institute's Committee on Manufacturing Problems.

The Group sees no advantage in converting to the metric system. It would produce no increase in sales, and would increase costs substantially. However, the industry will continue to supply the needs of customers who order in metric sizes.

Metrication would require revision of several thousand product standards, placing an added burden on technical staffs. One-time costs of converting equipment and training would not be large if enough time were available. Premature replacement of capital equipment with a normal life of 30 to 40 years would be prohibitive in cost; replacement at normal wearout would entail added costs in maintaining two types of equipment. Total recurring annual costs during a 5-year transition are estimated at as much as 3 percent of sales. Because of the considerable cost involved in conversion to the metric system, the industry might need some form of financial assistance, such as a tax relief.

Any program of metrication should provide 5 years notice before the start of the transition, with a firm completion date set. The Federal Government should supply leadership in planning and coordinating the transition through suppliers and consumer groups. Such coordination would probably require legal immunity.

AMERICAN LADDER INSTITUTE

There is no advantage or need for the ladder industry to adopt the metric system. However, considering the world situation, there is realistically no choice but to convert.

Conversion without a well coordinated plan would create confusion and planned metrication would be preferred.

AMERICAN NATIONAL STANDARDS INSTITUTE

Prior to passage of the Metric Study Act, ANSI set up a Metric Advisory Committee which has cooperated with all groups studying the metric system, including the U.S. Metric Study at NBS and its Metric System Study Advisory Panel. The ANSI Advisory Committee developed and published a "Metric Kit" for general information on the metric system. The kit includes these publications:

Orientation for Company Metric Studies
Guide to Impact of Metric Usage on Standards Development
Measuring Systems and Standard Organizations
ISO R 1000, Rules for Use of SI Units,
and in cooperation with ASTM made available the
ASTM Metric Practice Guide (now in process of adoption as an American National Standard)

ANSI supports the recommendations of the ISO Council to include SI units in addition to other units in all ISO Recommendations.

AMERICAN PETROLEUM INSTITUTE

The American Petroleum Institute is a trade association that includes all branches of the industry in the U.S., Canada, and Mexico. A majority of the members were queried concerning the increasing use of the metric system.

and they generally report that there is little present need for adopting the metric system. However, based on the recent experiences of the industry in Japan and the United Kingdom, it appears that the industry could convert without serious disruption.

The six operating divisions of API have differing opinions regarding metrication: the Accounting Division says it makes little difference, while the Production Division says the customary system is already established on an international basis so no change is needed. Other divisions take stands between these two positions.

The API Advisory Committee on Metric Planning favors increased use of the metric system to facilitate worldwide standardization, and supports an orderly and deliberate conversion. The overall cost of such a planned change could be as great as several billion dollars.

However, it would appear that being the only country in the world to use customary units would eventually erode the United States' position in international commerce, or alternatively, force the continuing use of an increasingly complex dual system. Conversion to the "International System" would probably benefit our national economy in the long run, and would certainly lead to the simplification of both engineering, and weighing and measuring standards.

AMERICAN RAILWAY CAR INSTITUTE

The main purpose of the American Railway Car Institute is to conduct research and promote standards for railway car equipment. While no poll was taken, the opinions expressed are shared by ARCI members.

Customary units are used exclusively; on cars built for foreign use the customary units are converted to metric units for shipment. There is no change to the metric system desired and no advantages are foreseen. A changeover could be fast and inexpensive, and reluctance to change is forestalling the inevitable. A start could be made using dual dimensioning until tooling is modified – over perhaps a 10-year period. Major problems would lie in modifying machinery and retraining shop operators.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

The Public Affairs and Policy Committee of the American Society for Engineering Education recognizes that in converting ASEE would face a language problem rather than a hardware problem, and that faculty and students would need education on the importance of engineering standards. A current mailing to deans of engineering offers material to aid in planning a program on SI units and standards. (See ASEE's report to the Education Conference for more details.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS

International standardization activities of the American Society for Testing and Materials (ASTM) goes back to 1898 when a number of U.S. members of the International Association for Testing Materials (IATM) organized an American Section. In 1902, the American Section of IATM was reorganized as ASTM.

Interest in international standardization reached a peak at the beginning of World War I. At that time, selected ASTM Standards were translated into other languages in order to promote their adoption internationally. Regulations issued in 1913, governing the form of specifications, stated "Units of measurement shall be expressed in both the English and metric systems, if, in the judgment of the committee concerned, it is desirable to do so."

This regulation was largely ignored after World War I, until 1963 when the Board of Directors took action to put ASTM in a leading position in an effort to establish a common system of measurement throughout the world. This action resulted in the issuance of the first ASTM Metric Practice Guide in 1964 and the inclusion of metric units in ASTM standards beginning in 1965. The Guide was revised in 1966 to incorporate SI units, and the revised Guide was issued by NBS as Handbook 102. The Guide became ASTM Standard E380 in 1968, and a 1970 revision has been submitted to the American National Standards Institute for adoption as an American Standard.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

The increased use of the metric system throughout the world requires greater recognition of metric units. In 1963 the Society adopted a recommendation that all ASAE standards applicable to metric areas use both customary and metric units.

Preference is given to SI except when some commonly used metric units (not recognized as part of SI) are needed to make publications readily understandable. Metrication is essential to promoting our influence throughout the world. A uniform base of units and values is essential regardless of any U.S. official action on SI.

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS

The American Society of Heating, Refrigeration and Air-Conditioning Engineers has adopted no policy on metrication, but its metrication committee has offered several recommendations for a policy applying to publications, including: all numeric units should be decimal; authors are encouraged to use SI units, or SI conversions for English units; and the 1972 Handbook should use SI as a basis for all conversion tables.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

This statement from the American Society of Mechanical Engineers was prepared by a special metric study committee, reviewed by 50 officers, and adopted by its Council in June 1970.

The ASME anticipates the displacement of customary units by metric units in many fields, with both systems continuing in use; dual capability therefore is needed. ASME will aid in the development of SI, and ISO R-1000 in particular, and participate in preparing conversion tables and dual dimensioning practices for mechanical engineering.

The Society will provide and promote education needed for dual capability, will encourage the use of SI in ASME publications and codes, and work with ANSI in increasing the use of SI.

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION

A consensus on metrication within the Anti-Friction Bearing Manufacturers Association is impossible because of wide divergence in product lines and export activity. The comments offered here reflect the views of two member firms.

About 60 percent of current production is already made to metric standards for bore, outside diameter and width, but manufacturing drawings and catalogs are in inches. Nominal millimeter bearings generally conform to ISO standards with dimensions shown in dual units, with tolerances given in inches.

Because a change to the metric system seems inevitable whether the industry wants it or not, most manufacturers are looking at transition problems. Most bearing parts are made to masters, and the dimensional label is not important. Inch leadscrews and dials on machine tools could be converted or replaced with metric components. Conversion of gages and comparators would be expensive. Conversion of those bearing types presently made to nominal inch boundary plans to nominal metric sizes would nearly double the number of bearing sizes without increasing the volume—aiding foreign competitors who would no longer have to produce inch bearings to capture more of the U.S. market.

However, the U.S. position as the only user of the inch system is untenable, and a change to the metric system is inevitable.

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

These comments are based on the results of a questionnaire survey of the Association of Home Appliance Manufacturers. The report is a consolidation of the opinions expressed and is not an official position of the Association.

The customary system is primarily used by most manufacturers with some metric system usage in research and testing. Dual dimensioning is used with foreign operations or for components purchased abroad.

There are no important advantages foreseen in metrication, but if it comes, dual systems would be needed for years. At least 10 years would be needed for an orderly replacement of drawings, standards, and tools. One complete generation of consumers should be educated in the metric system before starting conversion.

One disadvantage cited to the use of the metric system is that consumers would not understand new certified performance values. AHAM supports international standardization of performance and safety regulations through the International Electrotechnical Commission to keep the door open to future overseas markets. Presently the Association encourages the use of dual systems with metric units in parentheses.

Metrication could open further domestic markets to imports, and reduce U.S. production volume. The industry exports few products because home appliances designed and built in the U.S. do not lend themselves to use in foreign homes. Most U.S. manufacturers design and build appliances in foreign countries for use in those countries.

AUTOMOBILE MANUFACTURERS ASSOCIATION

The Automobile Manufacturers Association is a trade association of the eight U.S. automobile and truck manufacturers. All members were consulted in preparing this material. Their comments are restricted to the domestic production of highway vehicles.

The current use of the metric system in the United States operations is confined to electrical units and some research work. Some design for overseas manufacture has been in metric modules; other designs are done in customary units and converted to metric units. Some use is made of dual dimensioning, and some material sizes are adjusted to local practices.

AMA favors increased use of metric units through voluntary evolution based on need. There is no tangible reason to adopt metric units exclusively, and a program of planned metrication does not seem desirable at this time. Increasing worldwide metric use has no effect on U.S. production.

For the U.S. to prosper in a metric world, SI should be taught in order to develop a bilingual capability. Education in the use of metric units should be assured at all levels beginning with the grade schools. Metric translations of national engineering standards should be developed as needed.

BUSINESS EQUIPMENT MANUFACTURERS ASSOCIATIONS

This report does not represent a consensus of the 70 Business Equipment Manufacturers Association members, but does present an expository look at the current views held by some BEMA members in an attempt to span the range of opinions available. It has been reviewed by the policy boards of the three BEMA groups.

At the present time, BEMA members normally use the customary system of weights and measures. As purely a defensive measure, because some companies must operate in an increasingly metric world, they are using dual dimensioning systems on their documents. The module sizes are, however, normally based on the customary system of measure.

BEMA members are concerned about the present multi-dimensional environment and would prefer a single system of units of measure. Since a preponderance of nations are tending toward the metric system, it appears to be the system which will be preferred in future international trade. If the U.S. is to be drawn into the increased use of metric units of measure, a planned transition rather than an evolutionary transition would be preferred.

Within the United States' manufacturing and distributing facilities at present, there is no pressure or need for the change to metric units of measure. There is the fear that to change would require increased capital equipment investment and a possible temporary reduction in plant efficiency. On the other hand, there would also be the possibility that the long range result would be an increase in BEMA companies' productivity because of the new capital equipment.

Whether or not the United States changes to metric units of measure, strong support must be given to U.S. participation in international standardization to help guide and select parts with full consideration of the economic impact on customary units sizes.

CAN MANUFACTURERS INSTITUTE

The membership of the Can Manufacturers Institute was consulted in preparing this report.

In the industry, except for some isolated use of metric units for film thicknesses, all measurements are in customary units. Some equipment purchased abroad is built to metric standards. There is no planned increase in metric usage, and increasing worldwide usage has had no effect on U.S. manufacturers. Metal cans are neither imported nor exported in any quantity.

There is no incentive to metricate, and much resistance to it. Under a planned changeover, the cost would be minimized if present can sizes were retained and new labels prepared. If can volumes must be changed, it would be less costly to retain present can diameters and adjust the length only. ISO TC-52 is presently working toward standardizing can diameters to present U.S. dimensions except for one size.

Process equipment has a very long life and replacement parts would have to be kept available for many years. Can companies that make their own machinery would have to maintain dual capability. Conversion costs and changeover times would be comparable to other machinery fields.

COPPER DEVELOPMENT ASSOCIATION

The mission of the Copper Development Association is market development; its members cover the entire range of copper and copper alloy fields. These comments reflect the thinking of the Copper Development Association's Standards Advisory Committee.

The customary system is primarily used in all operations other than research. The industry actively supports the ASTM policy of dual values (customary and metric) in all copper standards. Industry engineers are active in ISO and COPANT which is producing some harmonization. Otherwise, the increasing worldwide use of the metric system is having no effect on the copper industry.

Planned metrication would reduce productivity temporarily during the transition period, but would bring a permanent change for the better. Metrication would have a greater impact on customer industries.

ELECTRONIC INDUSTRIES ASSOCIATION

These comments are based on the results of a survey conducted by the Metric Study Panel of the Electronic Industries Association.

Fifty-three percent of the firms have increased their use of the metric system in the last 10 years, but 90 percent have no plans for any further increase. Nevertheless, a majority of the industry feels that increased metric use is inevitable, and favor a changeover the sooner the better.

Of those companies who have used the metric system, 79 percent are strongly or mildly in favor of increased use. Of those who have not used the metric system only 48 percent are strongly or mildly in favor of increased use.

Concerning the transition time needed for metrication, responses indicate an average of 10 years, with many indicating a shorter time. A coordinated program would be essential, with legislation establishing a target date and voluntary changeover by industry.

FARM AND INDUSTRIAL EQUIPMENT INSTITUTE

The Farm and Industrial Equipment Institute recognizes the effects of increasing worldwide use of the metric system. It appears that the industry favors metrication, and an optimum transition period of 15 years would better fit its long product development cycle.

Dual dimensioning is common for equipment produced here and abroad, in expectation of foreign need. Standard inch fasteners would be no problem for they are available most places in the world, but structural steel would be a problem. SI has many benefits, particularly for standards, and it will become the world system, but there would still be problems with it that would need to be resolved.

The cost of conversion could be in line with normal retooling if metrication takes place as obsolete machines were replaced. Conferences between manufacturers and suppliers to resolve transition problems could have legal implications unless immunity were provided.

FORGING INDUSTRY ASSOCIATION

At present the customary system is used predominantly, with some metric usage related to foreign sales or the use of imported equipment. Conversion without coordination would be undesirable since it would be too slow and too confusing. Planned metrication would be the desirable method of conversion. The industry's customers, of course, would set the pace, with careful coordination.

The industry generally feels the cost and inconvenience of metrication would outweigh any advantages.

INDUSTRIAL FASTENERS INSTITUTE

A questionnaire survey of the industry by the Industrial Fasteners Institute brought this response: metrication would decrease domestic production and would increase imports.

IFI supports the continued use of U.S. standards (based on customary units) for fasteners because the products are technically superior to those based on metric modules. The cost of conversion to the metric system would be exorbitant with no compensating return.

If the U.S. converts to the metric system, a new system of metric fasteners should be designed for optimum performance. This "fresh start" should simplify the number and styles of fasteners. However, it could cost our industry as much as one billion dollars to introduce and maintain metric module fasteners. The pressure of increased costs on smaller companies would be proportionally higher than for companies with larger volume.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

This report was prepared by the Administrative Subcommittee of the Institute of Electrical and Electronics Engineers' Standards Committee which represents the Institute before other standardizing bodies. The major IEEE publications use metric units or show metric equivalents where original data was not metric. The units are limited to SI units. This policy does not affect the choice of units for manufacturing processes or industrial standards.

INSTRUMENT SOCIETY OF AMERICA

A Metrication Task Force, broadly representing interests in the Instrument Society of America, in a year of study prepared recommendations forming the basis for an official position that all new and revised standards should be written in the units currently accepted for the intended industry. If customary units are used, SI equivalents will be added in parentheses or in a conversion table.

The Task Force further recommends the implementation of SI units by education through taped programs, handbooks, Section meetings, and sessions at Annual Conferences, plus a "think metric" campaign in their monthly Journal. Each author should be given a copy of ASTM E380-70 as a guide for one of two procedures: if customary units are used, SI equivalents are added at the end; if mixed units are used, SI equivalents should be given in parentheses after all customary units; if feasible, SI units should be used alone.

MANUFACTURING CHEMISTS ASSOCIATION

The report was prepared by the Manufacturing Chemists Association's Mechanical Technical Committee (now the Engineering Advisory Committee), a standing committee responsible for engineering standardization studies.

Industry products can be packaged in any type of container, and measured by any system of units. Growing markets have developed overseas, but the products are generally made in overseas plants with raw materials and equipment purchased locally. The chemical industry can continue to do business at home or abroad without metrication.

An unplanned and/or mandatory conversion could cost the industry as much as a billion dollars, but a planned conversion with an optimized time schedule would cost much less. Metrication would lead to added costs in retraining technical people and clerks; in changing packaging equipment and recalibration of instruments; in additional inventories and changes in paperwork, computer programs, and records. There would also be added costs in dual stocks of spare parts; in revised specifications, operating instructions, and repair manuals; and in revised drawings, standards, and engineering computations.

Both these costs and offsetting commercial or technical benefits are difficult to quantify, and therefore it is not possible to determine any net effect.

NATIONAL ASSOCIATION OF PHOTOGRAPHIC MANUFACTURERS

At present, the customary and metric systems are both in common use.

The eventual increased use of the metric system is inevitable. Without federal coordination, chaos and confusion would result. The inevitability of the eventual widespread use of the metric system and the present potential for confusion if a laissez faire attitude were adopted indicates the need for the establishment of a well coordinated federal program for the adoption of the metric system. However, the changes should be guided by market demands and competition.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

These comments were prepared by the National Electrical Manufacturers Association's Metric Study Committee of five executives of representative member companies. Metrication poses such diverse problems that a formal consensus among NEMA's 500 member companies is not possible.

The customary electrical units are identical to metric electrical units. The kilowatt hour is universally understood as the unit of energy and should be preserved as a deviation from SI. Customary length and mass units are inch based, with no recent changes except for the acceptance of hertz for frequency. Decimal inches have replaced fractional inches, and some companies have gone to dual dimensioning for foreign markets. The present position of supporting customary units in international standards may become untenable with the loss of British support.

Metrication could be essentially completed over a 10-year period. Conversion costs could put U.S. manufacturers at a competitive disadvantage during conversion. A coordinated program would require definition of antitrust limitations. Standards organizations should determine whether the change should be to metric dimensions only or to metric modules also.

NATIONAL FLUID POWER ASSOCIATION

This report was prepared by the National Fluid Power Association's committee on metrication. No formal survey was made, and the report does not represent the official position of the Association.

The industry produces accessories for machines. U.S. companies with factories abroad have provided sales drawings in customary units for 15 years, but metric customers are now demanding metric shaft ends, flanges, screws, and port connections.

The United States is living with two systems, and the sooner it goes metric the better. The inch system is declining in world influence; the U.S. must change to the metric system to increase its exports. Manufacturers who have to design metric models of standard inch units would face increased operating costs that should be offset by increased sales. One approach to planned metrication would be for the U.S. military establishment to go metric for all new procurement, followed by the rest of the Federal Government. The rest of industry could follow as it wished.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

The National Machine Tool Builder's Association has taken no official stand on metrication since its statement in 1965 of opposition. This report is based upon the results of a recent survey of NMTBA members. The survey has not been reviewed by the Board of Directors and is not an official position.

Only 5 percent of the firms responding are using any form of metric units; 85 percent do not plan to increase the use of the metric system since their customers are not asking for it. For those increasing the use of the metric system, exports or overseas manufacturing is responsible. Most members export to some extent, but only 27 percent note any increase in demand for metric components. Nearly 60 percent feel that increased use of metric abroad would be disadvantageous to the domestic industry, yet a majority feel that the U.S. should convert.

NATIONAL SCREW MACHINE PRODUCTS ASSOCIATION

This report is based on the results of a survey of the screw machine products industry.

Half of the respondents have made parts to nominal metric dimensions, and 14 percent are currently doing so. Metric dimensioned prints are converted to decimal inches in the office for use in the plant. Forty-eight percent have cut threads to metric standards, but 75 percent have difficulty in getting threading tools. Only 12 percent were using any machines of foreign origin; 56 percent have difficulty in making metric parts on American machines.

Present experience shows that during any transition to the metric system when the operators would be working with both metric and inch parts, an estimated 6 months to a year of training with an estimated 20 to 50 percent loss in efficiency during the transition might be experienced. The cost of additional tooling could run from $50,000, according to a third of the replies, to $250,000 according to another third.

Few companies have ever produced for export, and 70 percent feel that metrication is not in their interest and that it would increase foreign competition. Many of the responses point out that the inch system screw threads should be retained because of their inherent superiority over metric screw threads.

NATIONAL TOOL, DIE, AND PRECISION MACHINING ASSOCIATION

The primary interest of the members of the National Tool, Die, and Precision Machining Association is in model production and tooling rather than mass production. Only a few of the members have foreign operations.

The Association has set up a metric study committee but has not conducted a survey. The industry would be one of the first affected by metrication, and would respond to their customer's requirements.

RUBBER MANUFACTURERS ASSOCIATION

The Rubber Manufacturers Association's membership embraces several industries with often dissimilar problems. Each comprises a separate division of RMA, and representatives of the various divisions within the Association have been consulted concerning the contents of this paper. The position represented is of necessity a composite view. Consequently, the views of individual members or divisions of the Association might differ in some respects.

Most of the products that the rubber manufacturing industry produces are component parts with the dimensional characteristics controlled by the designer of the original equipment. Consequently, the industry is not in a position to voluntarily change from using the English system of measurement to using the metric system. If original equipment manufacturers should decide that all new designs be in metric units, it is estimated that the majority of rubber products would be manufactured to these dimensions within 10 years.

The rubber industry is a participant in international markets. The Association is also deeply involved in the development of international standards within the International Organization for Standardization. Participants in these activities have come to realize that if the United States should decide it is in its best interests to convert to the internationally recognized metric system, we should avoid considering the adoption of a strict mathematical conversion.

From the standpoint of efficiency of production, clarity of communication, and efficiency of distribution of products, it would appear that one internationally accepted system would be preferable. Whether this will be SI, English, or some other measurement system should be determined through natural selection in the international marketplace.

SCIENTIFIC APPARATUS MAKERS ASSOCIATION

Over one half of the Scientific Apparatus Makers Association's 200 member firms assisted in the preparation of this report; 90 percent of them export an average of 10 percent of their sales.

Most firms use customary units, but 45 percent use metric units to some extent, and this metric usage is traditional in some industries and for some instruments of European origin. Foreign subsidiaries and licensees use metric units. Nearly all movement to the metric system is recent, and most members feel that metrication is inevitable.

Problems related to metrication would be in training, duplicate drawings, and dual stocks of materials and components. The cost of conversion is difficult to estimate, and a short-term recovery of the costs would be unlikely. Anti-trust regulations would handicap industry-wide collaborations in changing codes and standards.

The United States must participate intensively in international standards development to avoid being excluded from world markets. Emerging markets are metric and will be difficult to exploit in the face of German and Japanese competition. It is estimated that metrication would increase exports and competition for 27 percent of the firms; 73 percent predict no impact on exports.

SCREEN MANUFACTURERS ASSOCIATION

Present unit usage is predominantly customary, and adoption of the metric system is favored.

SHIPBUILDERS COUNCIL OF AMERICA

The Shipbuilders Council of America is a national trade association composed of major shipbuilding and ship repair yards, and suppliers of ship component parts. This report was prepared by the Technical Committee of the Council and reviewed by member companies.

At present the entire shipbuilding and ship repair industry of the United States is using the customary system of measurment. However, in recent years there has been increasing exposure to the metric system precipitated by the use of foreign made equipment in new ship construction, and also, ship repair.

The metric system could be adopted by the shipbuilding and ship repair industry as an element of a planned national metrication program. However, it must be stressed that at the present time, the industry has no incentive to convert on its own and therefore must be influenced by its customers and, due to the gross complexity of shipbuilding versus the individual specialized equipment manufacturers, must be preceded in the conversion by these manufacturers.

It is reasonable to conclude that the shipbuilding industry would be hindered in participating in the commercial maritime field on a worldwide basis should the United States, as a nation, not take a positive stand advocating the acceptance of industry-wide metrication.

SOCIETY OF AUTOMOTIVE ENGINEERS

In 1969 the Society of Automotive Engineers adopted a policy to provide education in the use of SI, and include SI units in SAE standards.

SAE encourages the use of SI in papers, and promotes United States standards for worldwide use. ISO R-1000 is the basis for this use, with elimination of the kilogram-force and calorie. Certain deviations from pure SI are desirable: decimal division of plane angle, conventional time, Celsius temperature scale, the nautical mile restricted to navigation, Pascal instead of newton per meter for pressure, and the liter without prefix for liquids.

SAE has published standards for dual dimensioning and conversion practices to assist a transition from the inch to the millimeter. SAE urges concurrent use of SI because of its growing world importance. SAE also urges increasing participation in producing goods to international standards.

SOCIETY OF THE PLASTICS INDUSTRY

This report is based on a survey of the members of The Society of the Plastics Industry. SPI is divided on the increased need for the metric system, and it takes no official stand.

Materials suppliers are the only group to show a majority currently using both customary and metric units—customary in the shop, and metric in the lab.

Increasing use of the metric system is affecting about 25 percent of the material suppliers, and 30 percent of the machinery manufacturers through stronger competition in foreign markets and loss of export business. In regard to the need for a change to the metric system, 96 percent of the firms replying have made no change and plan no future change, but 41 percent have a desire to change. Reasons offered in support of a change are ease of calculation, better communication, less confusion, and more accuracy. Those with no desire to change see difficulties in training, added costs for dual stocks, and production loss during conversion, but even some of those indicate a readiness to change "if everybody else does."

U.S. SCREW SERVICE BUREAUS

A survey of the eighty manufacturers in the screw, nut, rivet, and aerospace fasteners industries in eight trade associations served by one technical director shows all firms in favor of staying with customary units because of the technical superiority of present U.S. thread standards over comparable metric standards. The companies support the position of the Industrial Fasteners Institute that a new metric system of fasteners should be developed if metrication takes place.

Fastener manufacturers will make metric fasteners if customers order them. Deficiencies in the metric engineering standards could be overcome, and the high costs of change could be met, but fastener users should be aware of the enormous costs involved. Changes in fasteners would be a major part of the national cost of metrication.

IX. CONSUMER-RELATED INDUSTRY

A SUMMARY OF INPUTS

Metrication is favored and/or considered inevitable by a majority of trade associations and professions serving the food, clothing, printing, transportation, and entertainment needs of consumers. A few oppose a change as offering no return for the cost of conversion; for others, a changeover would make little difference after consumers were educated. Among the 37 inputs received, 19 groups feel metrication is inevitable and/or desirable, three prefer to make no change, and 15 indicate no preference. A majority of groups (30) are already using metric units in their technical work and some are producing products that are wholly or partly metric. Only seven groups indicate no present metric usage.

Every group but one that takes a position on metrication favors a nationally coordinated voluntary program, preceded by some time for preparation. The time recommended for conversion generally varies with the rate of inventory turnover. Some retail operations could convert in 2 or 3 years, or even as little as a few months in some areas. In some food lines, metrication would require changes in legislation at local, state and national levels, and this might take up to 5 years. Most other groups feel 10 years would be an adequate transition time.

Consumer Education

Educating consumers to metric usage would be the major problem in relation to metrication that these consumer-related industries would face. People would need to learn to "think metric" and unlearn years of experience with customary units. Many groups suggest that education should start now with elementary school grades where it would be easy, and they feel increasing difficulty would be encountered with older age groups.

Dual labeling is frequently suggested as a means of introducing consumers to metric equivalents. The museums offer to develop visual exhibits to explain the metric system and show its advantages to large adult audiences in major cities. The toy industry suggests that special toys and games could assist in education.

Other Problems

The training of machine operators and maintenance workers is also seen as a problem by many associations. Automobile repair already involves a need for metric tools, and the number of foreign cars is increasing. The training of retail clerks might present a more critical problem. During the transition period, clerks in retail stores would need special indoctrination so they could assist customers in using the new metric sizes and dimensions.

Other problems expected by many of these industries include:

(1) Added costs from errors during transition.
(2) Additional inventories of materials and spare parts needed for servicing older equipment.
(3) Cost of converting scales and weighing machines, particularly for computing scales.

Advantages of Metrication

Several advantages are cited that could come with metrication. The ones most often mentioned are opportunities for standardization on fewer package sizes for food and for warehousing and increased export opportunities. Others include the replacement of cumbersome sizing systems for shoes and clothing, the replacement of fractions by decimal values to simplify pricing and the use of computers, and the reduction of errors now encountered in converting hundredweights, tons and gallons in export documents.

Inputs from Individual Groups

AMERICAN APPAREL MANUFACTURERS ASSOCIATION

The report is based on a survey of member firms. The replies are quite diverse and it is not possible to summarize the industry's position. However, the following generalizations are possible.

The apparel industry, which primarily uses the customary system, is not likely to go metric alone—it would need close coordination with its suppliers and customers. In the event of metrication, as the apparel manufacturing industry is a highly labor-intense industry, the retraining of personnel is expressed by most respondents as being of critical concern.

AMERICAN ASSOCIATION OF MUSEUMS

The report is based on an informal survey of museums. The unanimous feature of all the replies is that museums are heartily in favor of a change to the metric system. Without the adoption of the metric system in the United States, the museums would be isolating themselves from the rest of the world in terms of interchange of data and programs. The only way the U.S. can become a member of the global community in these matters is to adopt a universal system—the metric system. If the system were adopted, there could be established a freer exchange program with the other countries of the world.

The primary function of the museum is to collect, preserve, interpret and exhibit the natural and cultural artifacts of our environment. Its primary mission is to diffuse and advance knowledge in our communities. There is a general feeling that museums would play a major role in the public acceptance of this system.

Museum personnel have long recognized that youth, coming within its walls, can learn anything which is taught properly. Even though conversion to the metric system indicates change, and change is resisted, the learning process could be gainfully exploited in the museums. Museums recognize this and many indicate they could develop, design, and build exhibits to demonstrate the advantages of the metric system.

AMERICAN FOOTWEAR MANUFACTURERS ASSOCIATION

A nonexpanding domestic production, excess capacity, and the lack of export opportunity could create a reluctance on the part of domestic shoe manufacturers to promote conversion to metric system. Nevertheless, the footwear industry would look positively on metrication, as long range prospects would outweigh the short term economic considerations.

The primary long range benefit would be achieved if metrication along with standardization could help in the development of automatic production equipment. Such automation would improve the competitive position of American shoe manufacturers in the world shoe market.

AMERICAN FROZEN FOOD INSTITUTE

The customary system is used almost exclusively by association members. Packaged foods may occasionally show a dual weight declaration in the customary and the metric system to permit either domestic or export sales.

A planned program for a change to the metric system would be more appropriate than a voluntary application brought about by gradual increased use. The expense of new packaging material, labels and new equipment for determining weight compliance would be unnecessarily costly. Industry resistance could be expected.

AMERICAN LEATHER CHEMISTS ASSOCIATION

The American Leather Chemists Association's members use primarily customary units. However, the Association includes metric units for use in its publications and standards.

AMERICAN MEAT INSTITUTE

The meat industry presently uses the customary system, including extensive use of decimal pounds. There is some confusion with sizes and weights with these present units. Planned metrication would cause problems relating primarily to retraining and additional inventory.

AMERICAN PAPER INSTITUTE

This report is based on a survey of member firms. Practically every company stresses that conversion to the metric system would present problems, many major. These would include a long-time added inventory of spare parts; conversion of all types of records and statistics; and conversion or replacement of scales, gauges, and similar equipment. Most, but not all, of the respondents indicate that there would be long-term advantages in converting to the metric system, but in every case the disadvantage stressed was the high cost of conversion.

Based upon the survey, it seems that certain long-term advantages could result for the paper industry under a planned national program to adopt the metric system. If a majority of United States industries and individuals favor the adoption of the metric system by the United States, it seems reasonable that this effort would receive the support of a majority, but not all, in the paper industry.

AMERICAN SOCIETY FOR QUALITY CONTROL

The report is based on a selected survey of members of the American Society for Quality Control's divisional committees.

Metrication is going to happen since the United States is not self-sufficient and must trade with other countries. It is a waste to demand that other countries make their products in customary units for consumption by the U.S. In the future, other countries will not accept goods in customary units. The only question is how long the U.S. is going to wait before converting to metric units.

The industry with which the ASQC member is associated determines the system of weights and measures he uses. Since nearly all industries are covered, both customary and metric units are in use. The scientific and research laboratories normally use metric units while engineering development laboratories and production activities use customary units.

The effect of metrication on product quality and reliability during the conversion period would be reflected mainly in the numerous chances for human errors resulting in poor quality and reliability.

AMERICAN TEXTILE MANUFACTURERS INSTITUTE

The consensus within the textile industry is that there is no particular reason why conversion to the metric system could not be accomplished. However, there does not seem to be any urgency in making this change. The textile industry could change completely to the metric system but not without certain problems, the greatest of these being educating employees and the cost involved in changing most machinery, instruments, and records.

ASSOCIATION OF AMERICAN PUBLISHERS

At present, unit usage is primarily customary, but the metric system is used where needed. Planned metrication should cause no problems since the industry is only concerned with editorial content, not sizes. Publishers could produce the needed books.

AUTOMOTIVE SERVICE INDUSTRY ASSOCIATION

At present unit usage is primarily customary, with the majority of firms (75%) using customary units only. The remainder use both customary and metric units. If the country were to go metric, a program of planned metrication would be preferred.

BOOK MANUFACTURERS' INSTITUTE, INC.

There is definite opposition to increased use of the metric system in the book manufacturing industry. Direct costs of conversion along with the confusion and other indirect costs that could occur could put this industry in an unfavorable economic position, both domestically and internationally.

The major problems in the book manufacturing industry under planned metrication would include retraining skilled craftsmen, operators and other personnel (a major expense which could require consideration of a subsidation of the industry), cost of errors during conversion, increased communication difficulties, parts replacement, and duplication of inventories.

If planned metrication were to be adopted, the conversion would have to be planned jointly with book manufacturers, publishers, commercial printers, printing and binding machinery manufacturers, paper makers and material suppliers working closely with the Department of Commerce.

COMMERCE AND INDUSTRY ASSOCIATION OF NEW YORK, INC.

This report is based on a questionnaire survey of member firms, seeking answers primarily to the effects of metrication on foreign trade. The report presents the reactions of business firms making their livelihood in selling goods and services to buyers outside the United States. They have years of experience with their overseas agents and distributors and are in a position to know at first hand, often through direct personal contacts with their foreign counterparts, the extent to which their international trading operations may be affected by metrication.

Most of the expressions of opinion received are favorable to a move to the metric system. The returns generally indicate that many foreign traders are unable to predict the extent to which metrication would affect their export operations. However, only 3 percent are opposed to metrication because of conversion costs; 28 percent anticipate increased exports under the metric system; and 76 percent anticipate no effects on their international business, yet they favor change.

Some firms express concern that United States exporters now supplying replacement parts for industrial equipment, parts which can only be obtained in the United States, would lose out to low-cost foreign producers of similar replacement parts if the United States converts to the metric system. They also express concern that many units of original equipment, which are now produced only in the United States, would become available from other countries if the U.S. goes metric. The net result, then, could be an overall loss in United States export trade. Despite this possibility, the majority of the firms responding to the inquiry feel that metrication would be advantageous to American business in the long run.

CORDAGE INSTITUTE

Present unit usage is primarily customary in purchasing, manufacturing, and sales. Laboratory operations are sometimes metric. Planned metrication could be accomplished in 10 years. There should be no resistance to the change; people readily adopt slang and jargon, so the language would not be a problem.

EVAPORATED MILK ASSOCIATION

Present unit usage is primarily customary, but there is some dual labeling for export purposes. Since it is not expected that metrication would lead to any changes in container sizes, there would be little impact. Problems would include communication with consumers, and consumer reluctance to duplicate equipment for measuring, and possible weighing of food ingredients for preparation at home.

INDEPENDENT GARAGE OWNERS OF AMERICA, INC.

The customary system of weights and measures is in common use in the automotive repair industry in the U.S., although isolated parts are subjected to some metric use. Except for the Pierce-Arrow, which used the metric system almost exclusively, there has been no conversion to the metric system in the automotive service industry.

Most persons in the automotive service industry appear apathetic about possible metrication, not because they are ignorant of the far-reaching significance of such a transition, but because they feel others would, of necessity, make the decisions that would affect a change.

The automobile manufacturers, for example, will decide for the industry whether or not metrication comes and how soon. Nevertheless, if the change were made gradually and without undue cost to the small shop owner, there should be no measurable opposition to metrication from the automotive aftermarket. In fact, many members have expressed the opinion that it is inevitable.

THE INSTITUTE OF FOOD TECHNOLOGISTS

At the annual meeting in May 1970, the Council and governing body of the Institute recommended by unanimous vote that the metric system be adopted in the United States as soon as practical. Members were encouraged to lend their effort and support to the conversion.

The advantages of converting to the metric system are obvious. For the food scientist and technologist it would obviate the need for constant conversion from one system to another in order to compare data from different sources.

Fortunately for the food scientist, measurement units used in recent instrumentation are now metric whether the instrument is of U.S. or other origin. It may be stated therefore, that complete conversion to the metric system would cause few problems for the food scientists, and would lead simply to the gradual discarding of the customary system as the industry becomes familiar with and adopts the metric system.

MOTION PICTURE ASSOCIATION OF AMERICA
THE ASSOCIATION OF MOTION PICTURE AND TV PRODUCERS

The motion picture industry uses both the customary and metric systems. Film widths are described the world over in millimeters (70 mm, 35 mm, etc.) and film lengths in feet in the U.S. and meters in metric countries.

It seems that the inescapable logic of the metric system would encourage all counties to adopt it as rapidly as possible, despite the relatively unimportant inconveniences – compared to the benefits – that would accrue.

Involvement with international standards organizations, which is necessitated by world markets, makes it obvious that the United States is only postponing the inevitable. The industry's experience has demonstrated that the longer one waits, the harder it is to make a change.

NATIONAL APPLIANCE AND RADIO-TV DEALERS ASSOCIATION

Conversion to the metric system would not create significant hardships for the nation's dealers, provided adequate notice is given. The major problem would be in the repair segment of this industry, primarily related to parts inventories.

NATIONAL ASSOCIATION OF FOOD CHAINS

At present the customary system is used predominantly. Conversion to the metric system is favored. Planned metrication would facilitate customer price comparisons. There should be no difficulties in the changeover if adequate time is allowed. Ten years might be a reasonable period.

NATIONAL ASSOCIATION OF WHOLESALER—DISTRIBUTORS

The National Association of Wholesaler-Distributors feels that metrication is inevitable and would ultimately be worthwhile.

Wholesalers work with all kinds of products, some of them measurement sensitive but the majority not. Obviously the impact of a conversion to the metric system would be a function of the dependence on measurement units.

Problems that would be encountered include reeducation of employees and its accompanying problems and the possibility of extra inventory without increased sales. The second problem is quite important since increased inventory means increased costs, and unless this can be at least offset by added sales, it could be quite a problem in an industry with a small profit margin such as wholesalers generally have.

NATIONAL AUTOMATIC MERCHANDISING ASSOCIATION

The report is based on a random survey of representative member firms.

The position of the United States and of U.S. business firms in world markets is crucial to the health of the domestic economy and to our country's role in world affairs. Competitive capabilities of other nations could threaten the present position of American business firms in foreign trade unless all possible steps are taken to compete effectively, both through private enterprise and through Federal Government policies. An eventual change to the metric system appears to be inevitable and highly desirable as part of these efforts.

Both manufacturing and service firms in the vending and food service management industry would benefit from metrication since it is likely that both segments will be expanding further to foreign markets as vending services typical of the U.S. today find application throughout the industrialized nations of the world.

For the vending and food service management industry, the required time and investment in order to change to the metric system would affect the service company segment quite differently from the manufacturing companies. The service companies would be required to change their repair shops, and tool and parts inventory system. For some of the larger companies the cost could be extensive, but for the many smaller firms the total cost would not be crucial, provided the time period is adequate.

The vending machine manufacturing companies would incur considerable outlays in changing machine designs, engineering standards, tooling, procurement of components, production of parts and stocking of customary system components for customers while changing to the metric system over a period of years.

All vending company service personnel would have to be retrained, since gauges, temperature, pressure and mixing controls on food and beverages dispensers are based on the customary system.

A considerable number of federal, state, and local laws which deal with health, packaging and labeling regulations for products sold by vending machines would have to be rewritten and converted to the metric system.

NATIONAL AUTOMOBILE DEALERS ASSOCIATION

Present unit usage is primarily customary, with the exception of imported cars which are designed to metric standards. The benefits foreseen of going metric (e.g., more standardization) would be primarily for the manufacturer. The major concern of the automobile dealers relates to the service aspects of their dealerships. An average mechanic has $600 worth of tools, some of which would have to be replaced. The training of these mechanics would also be a problem.

NATIONAL CANNERS ASSOCIATION

At present, customary units are used in the canning industry except for laboratory research which uses metric units. There is little incentive to change to complete use of the metric system. However, once a conversion is made, there would be a positive net gain for the industry.

During the conversion period there would be considerable costs and confusion. The greatest problems would be in the cost of changing engineering specifications and standards, and in the maintenance and replacement of food canning and food harvesting machinery. The burden would be particularly heavy on small and medium sized firms.

THE NATIONAL COLLEGIATE ATHLETIC ASSOCIATION

It is the opinion of the National Collegiate Athletic Association (NCAA) that metrication is desirable and that a nationally planned metrication program is the best means of achieving this end.

The three sports which would be affected most are football, track and swimming. In other sports (e.g., baseball, basketball, golf, ice hockey, skiing, soccer, and tennis) the dimensions of the competitive areas and the specifications for the equipment used in each sport could be changed without affecting the competition.

With one notable exception, meets, games and matches sponsored by the NCAA and its members are conducted under rules based upon the customary system. During Olympic years and in all international competition, events in track and field are based on metric measurements. This policy was begun in 1932 and has been continued during each succeeding Olympic year.

International swimming competition is also conducted under the metric system, but the customary system is used for domestic meets, even during

Olympic years. Since American athletes compete at the metric distances in international track and swimming meets, increased competition at these distances in domestic events would probably help our athletes achieve better performances at international meets.

Not surprisingly, the one sport which would be the most affected is football, the game most peculiarly American. An alternative to changing (e.g., a change to first down and 10 meters or 10.94 yards) would be to make an exception for football and let it remain a game of yards rather than meters.

THE NATIONAL RETAIL MERCHANTS ASSOCIATION

The report is based upon a sample survey of the National Retail Merchants Association's member firms.

There is no special or pressing need from a retail standpoint to adopt the metric system in the United States. Retailers are not handicapped in any important way by present metric usage. There would be added economic burdens for the retailer and the consumer if the metric system were adopted. Nevertheless, it is felt that the eventual establishment of the metric system in this country is somehow inevitable. The shrinking world, the increase in communications, trade and travel, and the consensus that the metric system is essentially sounder than the customary system all combine to create pressures pushing toward adoption.

Throughout the entire planning and implementation process a degree of cooperation within segments and between segments of the economy would have to be established far exceeding anything now existing. The absolute essential to all of this would be education, communicating to the entire country what metrication is and why it is being adopted.

NATIONAL SCALE MEN'S ASSOCIATION

Present unit usage is primarily customary, with an estimated 5 percent of scales presently manufactured and serviced being metric. The Association feels that the U.S. should begin to convert to the metric system as quickly as possible. It would be a mistake if there were no planned program and encouragement by the Federal Government. Major problems foreseen include training, increased inventory during conversion, and conflict with existing laws.

NATIONAL SOFT DRINK ASSOCIATION

The National Soft Drink Association has not uncovered any industry desire to use the metric system or any dissatisfaction with the customary system, other than an expression for simplification in engineering. Members of the association have not experienced any impact of increasing worldwide or domestic use of the metric system, except in international divisions.

Planned metrication, following an optimum time period and changing language only, would cause no extraordinary difficulties.

One point regarding metrication must be emphasized. The impact of standardizing on metric unit containers, other than on an equivalent basis would be of such proportions as to almost preclude consideration. The industry is dependent upon billions of returnable containers "in float," i.e. in various stages of cycling between bottler—retailer—consumer—retailer—bottler. To discard this inventory would be economically unacceptable. To commingle new, standardized metric units with present inventories is technically undesirable. To commingle new units with old in the current confusion in the market place would appear to be unthinkable.

THE SALT INSTITUTE

Domestic salt companies feel no present impact of increasing worldwide use of the metric system and international companies are making changes where they can economically be made. Although all members agree that there would be many problems encountered along the way, all agree that conversion would be desirable.

The producers generally think that metrication would make calculations simpler and choices of equipment more flexible. For example, those firms with international operations have made some changes in anticipation of metrication, and find that they have greater flexibility with regard to cost and performance when including metric equipment in their purchasing considerations.

Metrication would not be without disadvantages for salt producers. The major disadvantage would be the changes required for engineering standards and drawings. Other problems include equipment revision and retraining of workers.

SCALE MANUFACTURERS ASSOCIATION

The report is based on a questionnaire survey of member firms. In general the scale industry favors conversion to the metric system. It has two problems with respect to conversion of weighing scales to metric indication and recordations, namely, conversion of scale design for new production and conversion of the many millions of scales, now in use, to metric indications.

The production of new scales would cause problems not unlike those that would be encountered by the manufacturers of other types of complex equipment. Fortunately the industry has some experience since a great many scales produced in the U.S. are produced with weight indicators and recorders which reflect weight in the metric system for export to metric nations and for sale to U.S. companies that utilize the metric system.

Probably the most serious problem of a U.S. conversion of weights to the metric system is the adaptation of existing scales to indicate and record in metric units. There are an estimated five million scales in use today that would need to be converted to metric. The several thousand scale servicemen presently operating in the nation, even if qualified to convert most models to metric, are presumably busy at present with servicing existing scales and thus could not devote full time to a new program of converting them to metric.

THE SEWING MACHINE TRADE ASSOCIATION

There would be no great advantage to the industry from conversion. If undertaken, however, there should be ample time provided for the conversion, and there should be some tax credit or other means to defray the expense involved.

THE SOAP AND DETERGENT ASSOCIATION

The report is based on a survey of member firms.

At present, the customary system is primarily used, and about half of the survey respondents indicate use of the metric system in certain operations (temperature and quantity control in laboratories, in foreign trade transactions, etc.).

Planned metrication, rather than sudden conversion, is preferred. If this were accomplished over a decade or so, and allowed for accommodation and adaptation of existing systems, the cost might be contained within the framework of orderly change. The guiding principle would be to have the measurement system(s) help designate what is in the marketplace but not control or hamper the normal functioning of trade and commerce.

Advantages of metrication would include the enhancement of international trade through the use of a worldwide system of standard weights and measures; simplification of product formulation scale-up from laboratory processing; simplification in manufacturing, packaging, and labeling operations; easier billing; and easier engineering calculations with less chance for error.

The major problems would include the high cost and time involved in recalculating formulae, recalibrating scales and other measuring devices, converting processing equipment, reprogramming computers, retraining employees, and educating customers and suppliers.

SOCIETY OF MOTION PICTURE AND TV ENGINEERS

At present, all technical national and international motion picture standards incorporate both the customary and metric systems.

Some means of eliminating the dual system that is in use is favored. Metrication would, of course, accomplish this.

THEATRE EQUIPMENT AND SUPPLY MANUFACTURERS ASSOCIATION

The metric system is used in some aspects of the theater industry. For example, light sources for projection are generally metric.

There is a moderately strong feeling against any further conversion to the metric system. The primary reason is economics. The total production of motion picture equipment and hardware is small and the cost of new machine tools, new dies, etc., would be out of line with the life of such tool productivity.

Another factor in the lack of interest in conversion is the absence of what would be considered obsolescence in any other industry. Over half of the projection systems in use in commercial theaters were built by companies that have been out of business for 10 or more years. There are specialty machine shops that continue to make repair or replacement parts for this equipment, and regular maintenance keeps them running. It is estimated that this sector of the industry is considerably larger in economic importance than the sale of new equipment.

TOY MANUFACTURERS OF AMERICA, INC.

Many toy companies have substantial business abroad, and these firms are already using the metric system on drawings for tooling and parts manufactured abroad.

The toy industry does not see an immediate need for the further use of the metric system, but can foresee the day when it would be advantageous to adopt the system to facilitate working with the rest of the world. In fact, it would appear that the sooner the conversion started and the more rapidly it progressed, the cheaper it would be for the country to achieve it.

It might be somewhat more costly to operate during the conversion period because of the need for carrying double standards and employing conversion devices. Engineering problems of a conversion should be minimal since most engineers are already familiar with the metric system. But it is expected that conversion devices for existing machinery would become available through American initiative and ingenuity.

VINYL FABRICS INSTITUTE

At present, the customary system is used in the vinyl fabrics industry. Planned metrication is not favored. No national program is favored since it is felt this would minimize confusion and reduce costs. Problems foreseen include changes in product formulation and changes in scales and other measuring devices.

X. NATURAL RESOURCES, TRANSPORTATION, HEALTH, SMALL BUSINESS AND OTHERS

A SUMMARY OF INPUTS

The concluding group of reports is made by representatives of agriculture, forestry, fisheries, mining, transportation, small business, state and local government, communication, public health, finance, and professional services. Many of these groups expect to be little affected by metrication, in sharp contrast with the manufacturing, consumer, and educational sectors of the society.

Among the 57 groups supplying inputs, 46 groups report some amount of present metric usage, and only 11 indicate there is no such use. A majority of the associations and societies covering many diverse sectors of the economy feel that metrication is inevitable and/or desirable. Some groups are firmly for a change, and many of the groups see no great advantage to conversion, but accept it as inevitable and indicate a willingness to go along with a change for the nation's good. Twenty-nine groups express such opinions, only one is firmly opposed, and 27 indicate that unit usage does not matter to them.

A majority of the groups support a planned program, usually with a 10-year transition period. Only one supports conversion without such coordination. Nearly all see the need for a broad program of public education to support a planned changeover.

Agriculture, Forestry, Fisheries, Mining

Farmers expect no advantages in metrication, but expect little disruption if adequate education precedes any change. The major impact on agriculture would be the confusion and inconvenience of learning to think in a new system. Aside from this learning process, changes in measuring equipment such as scales would be the most difficult problem. Agricultural economic reporting would be greatly simplified by conversion. Foresters expect a changeover to lead to a better system for measuring timber. Changes in land measurement could be a problem and would need careful study. Fisheries could change over in 10 years at little cost. Mining expects no return to offset conversion costs.

Transportation

The technical advantages of metric usage are generally recognized by the transportation industries, and ultimate adoption is considered inevitable. Planned metrication could eliminate many needless container sizes, and simplify billing computations. The major concerns would be the area of the repair of transportation vehicles, especially related to mechanic training and parts inventories. However a 10-year transition would minimize equipment costs.

Public Health

Metric units have been used almost exclusively in health related areas for many years, and this uniformity aids in the safety of medicine administration. Conversion to the metric system is desired and would create few problems in the area of public health. A 10-year conversion time should be backed up by a program of consumer education.

State and Local Government

Most officials see no savings in metrication but recognize some possible long-range advantages. They feel the Federal Government must take the lead. A 5-year planning period followed by a 10-year conversion program would meet most needs.

Finance and Professional Services

Bankers, accountants, credit bureaus, and securities dealers would not generally be affected by a change to the metric system. Lawyers would need to change measurement language as their clients do, but this should cause no problems.

Communications

The communications industry, since it relies heavily on electronic technology and equipment, is already metric to some degree. The industry generally favors metrication as it would simplify present operations by eliminating the presently necessary conversions and their inherent inefficiencies.

Small Business

Small businesses have a special concern in the metrication area since they would in general have fewer resources than larger firms to handle any changes needed. A majority of small businessmen favor conversion but feel that it must be carried out as part of a national plan.

Inputs from Individual Groups

AIR TRANSPORT ASSOCIATION

There is no immediate need for airlines to convert to the metric system, but a nationwide changeover can be justified on grounds of simplicity and keeping in step with the rest of the world. A planned program is favored.

The optimum period would be 2 to 3 years for in-flight operations; 15 to 20 years for operational support activities. The costs would be great unless based on obsolescence. There would be concern for safety during a transition period due to human error.

AIRPORT OPERATORS COUNCIL INTERNATIONAL

The consensus of airport operators is that use of the metric system would be of minimal consequence. The United States has for many years been a member of the International Civil Aviation Organization therefore many segments of the aviation industry have been two-system oriented for years.

The biggest impact within the membership would be suffered by the large hub airports that have an in-house engineering capability. The medium and smaller hubs in most instances contract their work to outside consultants, thus the problem is transferred to other industries, primarily the architectural and engineering professions.

In general, conversion to the metric system would be an inconvenience. However, once the habit were acquired to think and plan in terms of the metric system, the inconvenience would be quickly minimized. If it is the decision of the U.S. Congress to convert to the metric system in the United States, the Airport Operators would be prepared to adjust accordingly.

AMERICAN AGRICULTURAL ECONOMIC ASSOCIATION

The metric system is used by agricultural economists in connection with data on foreign agriculture and international trade and for studies of food consumption and diets; otherwise, English units are used. Growing interest in foreign agriculture and international trade has caused expansion in the use of metric units. Dual measurement units cause confusion to many economists.

If the United States converts to the metric system, there would be substantial costs during the transition, but the gains would soon outweigh the costs. If adoption of the metric system could achieve a uniform system of measurements throughout the U.S. market for agricultural commodities, it would be very beneficial.

AMERICAN ASSOCIATION OF PORT AUTHORITIES

Port authorities would not encounter any difficulties in converting to the metric system. At present both systems are used in the manifesting of cargo. Present efforts are being made to standardize internationally such items as ships' capacity measurement.

AMERICAN BANKERS ASSOCIATION

The banking industry is not and would not be affected by any unit usage, except as consumers of other industries' products. There may be some impact in trust departments where commodities must be defined, and in records for mortgage loans. This would involve the reeducation of employees in these departments.

AMERICAN BAR ASSOCIATION

The legal profession utilizes the customary system almost exclusively. Legal instruments may be drawn in the metric system when the matters covered relate to scientific or technical questions.

If there were no national program to convert to the metric system, lawyers would continue to adapt to changed usage in client industries. Under planned metrication, the principal effect would be changed language in transactions.

Concerning the modernization of state statutes and regulations, a temporary arrangement could be made to accommodate to metrication. In the long run the state statutes and regulations requiring change would have to be identified. All state statutes are computerized, which would facilitate the identification task. By putting state regulations on a computer, as is being done in some jurisdictions, the modernization of these regulations would be similarly facilitated.

AMERICAN DENTAL ASSOCIATION

At present, metric measurements are used extensively. A recommendation has been made to the ADA that the metric system be used exclusively in the journals published by the Association.

AMERICAN DENTAL TRADE ASSOCIATION

There is little need for metrication and the costs would be substantial. Training during the changeover period would result in inefficiencies. For equipment, obsolescence would take 20 to 30 years; for materials, there would be no problem. The industry would prefer no change, but it will have to follow the machine tool industry.

THE AMERICAN DIETETIC ASSOCIATION

A confused mixture of customary and metric units now exists, but additional changes from the customary to the metric system are in progress in a number of areas.

Adoption of the metric system as soon as possible is favored. Planned metrication would be definitely superior. A time period shorter than 10 years would be preferred.

AMERICAN FARM BUREAU FEDERATION

At present the customary system is used almost exclusively and increased metric usage has had little impact.

Farmers have relatively little to gain from metrication, but they are increasingly aware of the importance of international considerations, and could be expected to adapt successfully. Under planned metrication intensive educational programs would be necessary and scales would have to be converted or replaced. A minor benefit would be the simplification of record keeping.

AMERICAN FISHERIES SOCIETY

The American Fisheries Society has considered the use of the metric system for a number of years. Since 1965, the AFS has had a Metric System Study Committee. The Committee recently recommended that the *Transactions of the American Fisheries Society* for 1971 use metric units in all papers. In 1970, the Executive Committee of the Society voted that starting in 1974 only metric units are to be printed in the *Transactions*.

AMERICAN GAS ASSOCIATION

The American Gas Association feels that the benefits of a single measuring system are so significant that conversion to the metric system is inevitable, and further that it should be carried out following a carefully planned program.

At present the U.S. gas industry uses the customary system of weights and measures with minor exceptions, these being primarily in dealings with foreign affiliates or in foreign transactions.

The impact of metrication on the gas industry would be felt in several areas of its operations, for example, in its production, transmission, distribution, utilization, hardware, international, regulations, and software operations. Some of these elements of the gas industry could lend themselves to adoption of the metric system without major disruptions or incurring a high degree of added costs. However, because of the magnitude and different types of equipment involved in the operation and servicing of gas transmission and distribution lines and customer-related equipment which uses gas. it is impossible to estimate the immediate or long-term economic impact which would be caused by converting to the metric system.

AMERICAN HOSPITAL ASSOCIATION

Hospitals. at present. use both metric and customary units. Conversion would cause no real problems since all medical personnel are familiar with the metric system.

AMERICAN INSTITUTE OF CERTIFIED PUBLIC ACCOUNTANTS

Accountants are involved with systems of weights and measures in connection with inventory evaluations. production statistics. etc. Accountants are concerned that one system of weights and measures be used consistently; the choice of the system is of no particular interest to them. Accountants would be ready to assist their clients in any problems that might arise during a conversion. and they would not need any significant amount of education in order to prepare themselves.

AMERICAN INSTITUTE OF MERCHANT SHIPPING

The customary system is used in U.S. operations. but foreign-flag affiliates of U.S. companies use metric units. Recently. dual measurements have been used for cargo containers. Foreign operations are increasingly metric. Companies agree that it would be simpler and more economical to have one system of measurement in the world. Without a national program. conversion would not be accomplished.

AMERICAN MEDICAL ASSOCIATION

At present a mixture of systems is used: metric is used in medical research; in offices and hospitals, drugs are metric, but the patient's height and weight are generally given in customary units. Since 1878 the AMA has been recommending the use of the metric weights and measures. Under planned metrication. physicians could adapt easily. The public would have to be educated so that they could follow the physician's instructions.

AMERICAN MINING CONGRESS

The customary system of measurement is used in the mining industry. with the metric system used only in foreign operations, the domestic use of foreign-made equipment, sales outside the United States, laboratory work and scientific research.

Total conversion to the metric system would have to be carefully planned. Many mining leaders see no advantage to their industry. while others can foresee some benefit. Retooling and additional inventory problems related to the processing and manufacturing operations subsequent to mining. would add to the costs. Errors would contribute to increased costs, and changed work methods would introduce new accident hazards. The retraining of personnel could be burdensome and costly, and legal work would be expensive.

AMERICAN NATIONAL CATTLEMEN'S ASSOCIATION

The beef cattle industry uses customary weights and measures exclusively. The industry has a lot of time, effort and money invested in records and merchandising systems based on customary weights and measures. Conversion to the metric system would necessitate the changing of all cattle records since they are used to analyze calf corps. There is presently a large investment in scales, formulas, management systems, selection systems, etc., in customary measurement units.

AMERICAN NURSES ASSOCIATION

Nurses would welcome a uniform measurement system. Present unit usage is a mixture of metric, apothecary, and customary units, with metric usage slowly increasing.

Under planned metrication, nursing education would not need to be modified appreciably; the greater need would be for the education of inservice practitioners who have not used metric units for a long time. There is a need for the development of a uniform code for the identification of drugs and drug sources and of standards for the uniform packaging and labeling of drugs. Conversion could aid in this process. Furthermore, using one uniform system would contribute to safety in drug administration.

AMERICAN OPTOMETRIC ASSOCIATION

Present unit usage is largely metric except for those areas controlled by suppliers; e.g., screw threads and temple lengths of frames. A complete conversion to the metric system would be a benefit to optometry and would cause no serious problems in the transition period.

AMERICAN PHARMACEUTICAL ASSOCIATION

Within the pharmaceutical profession the metric system is used exclusively. This has been achieved by an evolutionary method over a period of 75 years. The benefits gained by the profession of pharmacy from early adoption and continued use of the metric system include worldwide standardization and consistency within the profession. The American Pharmaceutical Association feels that a full and complete transition to the metric system is highly desirable for the United States. A planned program of conversion with a fixed time period is favored.

AMERICAN PUBLIC HEALTH ASSOCIATION

The use of the metric system is strongly endorsed by the American Public Health Association. The metric system has been employed, almost without exception, in all publications on standard methods or recommended procedures for the examination of water, milk, food, waste water, air, for the microbiologic diagnosis of infectious diseases, and in the books on laboratory methods published by the APHA.

AMERICAN TRANSIT ASSOCIATION

Present unit usage is almost exclusively customary, but Canadian and European usage is increasingly more metric. There are advantages to worldwide uniform metric standards, both to the transit industry members at international meetings and regarding the compatibility of mechanical components and equipment.

The necessity for U.S. science and technology to be compatible with science and technology throughout the world makes it imperative that the U.S. adopt the metric system as soon as possible. It must be a planned, federally coordinated conversion.

Careful national coordination is necessary. Buses have an expected life of 15 to 20 years and subway vehicles have an expected life of 20 to 40 years; dual inventories would be a long lasting concern.

AMERICAN TRUCKING ASSOCIATION

Present unit usage is primarily customary with some foreign-built metric engines in use. There is a great need for standardization in trucks and parts.

Conversion is regarded as inevitable. It would provide an opportunity to simplify and cut down on the proliferation of sizes of fittings, etc. There would be a problem in the retraining of mechanics, but tool kits might contain fewer tools and be less expensive if the number of items were reduced by standardization. There may be anti-trust problems in trying to get uniformity.

AMERICAN VETERINARY MEDICAL ASSOCIATION

Conversion is favored. At present, metric units are used except for dimensions, fever thermometers, and weights of animals and feedstuffs. Veterinarians are familiar with the metric system and periodicals of AVMA have used metric units since 1966.

AMERICAN WAREHOUSEMEN'S ASSOCIATION

Metrication is considered inevitable and would offer a good opportunity to standardize transportation and materials handling equipment such as cargo containers, pallets, etc. Since public warehousing and transportation are closely related in fulfilling the nation's materials storage and distribution requirements, their metrication plans should be coordinated.

A planned program by all industries would minimize the impact of metrication on public warehousing and transportation. Public warehouse operations are inherently flexible and changes would primarily involve measurement units in documentation and modification of scales. A mandatory and fixed time period of 10 years or less is favored. The costs of metrication in the public warehousing industry may be less than $1 million.

ASSOCIATED CREDIT BUREAUS, INC.

Credit bureaus are not affected by measurement units and thus there is and would be no impact due to any change in measurement system usage.

ASSOCIATION OF OIL PIPELINES

The metric system is not now used by the oil pipeline industry. Although oil pipelines are common carriers which do not buy or sell petroleum or petroleum products but merely transport these commodities in accordance with tariffs on file with the ICC, their "shipping public" is limited to producers and refiners of petroleum. Because of this close connection with the petroleum industry, the position of the oil pipeline companies regarding the adoption of the metric system is consistent with the position taken by the petroleum industry on this subject.

The position of the petroleum industry is that while it is recognized that being the only country in the world to use customary units would eventually erode the United States' position in international commerce, or, in the alternative, force the continuing use of an increasingly complex dual system, planned metrication would not be carried out in the petroleum industry unless a national plan were implemented by virtually all industrial sectors. Any program for such nationally planned metrication should be based on additional cost-time studies to arrive at optimum periods for a national changeover.

COUNCIL OF STATE GOVERNMENTS NATIONAL GOVERNORS CONFERENCE

Seven of the 16 state-wide administrative areas in the two states surveyed use the metric system in some phase of their operation: the Divisions of Weights and Measures in the Department of Agriculture, the Purchasing Offices, the Departments of Health and Mental Health, the Department of Corrections, the Department of Highways, the Water Resources Department, and the universities. Scientific activities are completely metric. The National Association of State Highway Officials publishes its recommended tests and standards for highway materials in both metric and customary units.

The only desirable way to accomplish metrication would be on a planned basis as directed by federal policy. Impacts would include changing highway signs and changing necessary laws and statutes. The Federal Government should bear the brunt of the expenses incurred, as any change of this nature would be most beneficial to it.

Despite objections, state officials as a whole are very positive about metrication and see many advantages, in the long run, although no particular savings are expected from going metric.

EDISON ELECTRIC INSTITUTE

The situation regarding the use of the metric system in the United States has been reviewed by the Edison Electric Institute which represents investor-owned power companies, and it concurs in the long range benefits to be achieved by ultimately converting to the metric system. However, it recommends that the present trend toward the metric system be allowed to continue at a moderate pace to avoid the excessive disruption which would occur during a specified conversion period as short as 10 years.

The investment of the investor-owned electric light and power companies in generating plants, substations and transmission and distribution systems is great. Regardless of any shift to the use of the metric system for new equipment, the thousands of elements of this tremendous amount of existing plant still will have to be maintained, repaired and replaced over a period of up to 40 years or more. The problems of maintaining the existing systems in the years following the end of a specified conversion period would be severe. For these reasons the Edison Electric Institute does not favor action which would accelerate the gradual pace of conversion to the metric system in the United States.

HUMAN FACTORS SOCIETY

Human factors specialists have an extremely difficult problem now because of the variety of disciplines with which they interact. Any simplification through a common system of definitions would relieve effort, error, and time, with the eventual result being a more cost-effective output.

INSTITUTE OF TRAFFIC ENGINEERS

Present unit usage is customary except that standards and tabulated data of some organizations are published in both customary and metric units. Planned metrication must be directed by the Federal Government. A changeover date with 5 years of lead time would be desirable. There is presently considerable interest in international standardization, such as in sign messages and symbols, and this interest should make any metrication activity more readily accepted.

INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE, INC.

Present unit usage is customary except that scientific crime laboratories use the metric system. There is little advantage to conversion but there would be no particular problems foreseen in law enforcement. Police would act only after laws have been changed and the public educated. Police themselves would need intense education to adapt.

INTERNATIONAL CITY MANAGEMENT ASSOCIATION, NATIONAL LEAGUE OF CITIES, U.S. CONFERENCE OF MAYORS

The report is based on a study of five typical cities. At present, the customary system is primarily used. Limited metric usage is found in the following activities: foreign vehicle replacement parts and tools, hydraulic theory in fire protection, pharmaceuticals, zoological gardens, materials testing laboratories, and swimming pool measurements.

The consensus of those contacted is that it would be difficult to identify benefits of metrication for cities. The usual general advantages are cited and some seem to think the change would call for ingenuity and be interesting.

Under planned metrication, advantages foreseen are simplicity, standardization, ready sources of products, increased competition, and lower prices. Major areas of impact are in police and fire protection and public works areas. Activities in the police areas that would be affected by conversion to the metric system include traffic laws, traffic investigation reports, crime scene reports, record systems, physical identification, and computer files. Major disadvantages would be the need to revise all ordinances and reporting forms and to retrain personnel. Fire protection activities affected by conversion include specifications for fire equipment, fire codes, vehicle maintenance, investigation, and hydraulics. Two sets of tools would be required due to the long life of fire equipment.

In public works, changes would take place in the design of water sewers and pavements. All surveys and plans would be affected. A tremendous volume of maps, plans and other records might have to be revised. All inspection and code enforcement activities would be affected by metrication. Dimensions and measurements affecting plan checking, inspection, fee computation, etc., would be changed.

METRIC ASSOCIATION, INC.

The Association was founded in 1916 to promote the use of metric units of measure in the United States' schools, commerce and industry. It has published several pamphlets, including *Metric Units of Measure;* a workbook, the *Metric Supplement to Mathematics;* the *Bibliography of the Metric System;* and the *Metric Association Newsletter.*

NATIONAL ASSOCIATION OF BROADCASTERS

The industry's business is electronics, and is already mostly metric. Therefore, any future conversion would have no impact.

NATIONAL ASSOCIATION OF COUNTIES

The report is based on a survey of two typical urban counties. The customary system is primarily used at present. If metrication were to be brought about, the coordinated approach would be favored.

There is a belief that metric conversion is going to become a reality and that the Federal Government is currently gearing up to make the change. County officials are prepared to cooperate but not to innovate. They view themselves as consumers, not producers.

Under planned metrication, impacts similar to those cited for cities were noted. The major problems were viewed as real but not insurmountable.

NATIONAL ASSOCIATION OF REAL ESTATE BOARDS

The subject of increasing metric usage has been reviewed by the various Institutes which make up the Association. Their opinions are as follows:

National Institute of Farm and Land Brokers: this Institute accepts the recommendation of their Agriculture, Urban Land and Legislative Committees that the group endorse the adoption of the metric system in the United States and support the pending legislation calling for a study of the adoption of the system in the U.S. Since the metric system operates on units or multiples of 10 it is thought that once the conversion is made, it would make land description and land measurement more exact.

Women's Council of the National Association of Real Estate Boards: a committee of the Women's Council looks favorably toward U.S. adoption of the metric system.

National Institute of Real Estate Brokers: the general sales brokerage group feels no great concern pro or con.

The remaining Institutes either took no action or deferred the matter for later consideration. These include the Executive Officers Council, the American Society of Real Estate Counselors, the American Institute of Real Estate Appraisers and the Institute of Real Estate Management.

NATIONAL ASSOCIATION OF RETAIL DRUGGISTS

At present, metric units are used almost exclusively with prescription drugs except that instructions to the patient are mostly in customary units. Over-the-counter drugs (without a prescription, for self-medication) are sold mostly in customary units.

The National Association of Retail Druggists supports increased use of the metric system. A coordinated program is favored. During any transitional period, drugs and nondrug items should be labeled in both metric and customary units.

NATIONAL ASSOCIATION OF SECURITIES DEALERS

Securities dealers are not affected directly by physical measurement system usage and thus there is and would be no impact due to any change in such usage.

NATIONAL COUNCIL OF THE YOUNG MEN'S CHRISTIAN ASSOCIATIONS

At present, the customary system is used in facilities except that the height of diving boards in swimming pools is measured in metric units. In training for Olympic events, the use of metric-sized swimming pools is favored. The National Council has no official position but it believes that with the growing ease of communication and travel, the desire for conversion will increase. A planned program would be preferred.

NATIONAL CRUSHED STONE ASSOCIATION

At present the customary system is used exclusively. Future impacts of metrication would be little except on heavy machinery and equipment.

NATIONAL FARMERS UNION

The membership takes no formal position on the merits of the metric system. Any program of metrication should be carried out in such a way as to cause the least possible disruption and anxiety to farmers and rural people. Dual units should be used for some time, and educational programs conducted.

NATIONAL FEDERATION OF INDEPENDENT BUSINESS

The report is based on a survey of members. The results indicate that less than one firm in 10 uses metric units. Professional firms report the greatest proportion of present metric usage; transportation firms report the greatest proportion of recent change to metric units. Manufacturing firms report the greatest proportion indicating plans for a future increase in metric usage.

Concerning possible conversion, 54 percent of the respondents are against it; 41 percent of respondents are for it. There is a consensus of 2 to 1 that any changeover must be part of a national plan involving an intensive educational effort. Though some small business firms are concerned about costs, none of the businesses appear to feel threatened by a possible changeover to metric; the majority seems to feel that it is largely an educational problem.

NATIONAL FISHERIES INSTITUTE

Unit usage is presently primarily customary. Exceptions are metric usage in purchasing raw and processed fish from foreign countries and in quality control work. Exported products are labeled with both systems. A planned program of conversion would be preferred. Under such a program, unit costs would be much more easily calculated by consumers. There is no reason why an orderly changeover in packaging and labeling could not be made within a 10-year period since most machinery and equipment has a 10-year life or less.

NATIONAL FLEXIBLE PACKAGING ASSOCIATION

At present the metric system is used in specific applications in about 50 percent of the firms for laboratory testing, foreign orders, etc. A majority of the firms favor conversion, notwithstanding the inherent problems.

NATIONAL LIMESTONE INSTITUTE, INC.

Presently the customary system is used exclusively. Increased use of the metric system under a nationally planned program is favored. Impacts would be relatively slight. Some alterations may be required to machinery and equipment.

NATIONAL LP-GAS ASSOCIATION

Present unit usage is customary except that firms marketing equipment overseas use metric units. There is no urgent need for conversion, and it would be difficult to justify for domestic marketing. If metrication were to come, planned metrication would be favored. Because of expensive existing equipment, it would have to be phased in at varying rates.

NATIONAL SAND AND GRAVEL ASSOCIATION
NATIONAL READY MIXED CONCRETE ASSOCIATION

Conversion to the metric system does not appear to offer any significant, specific, or special advantages for these industries other than the general benefit which accrues to nations as a whole or as a member of the overall construction industry.

At present, customary units are used except that in the sand and gravel industry sieve and screen sizes are stated in metric units as well as customary units. A changeover to the metric system would be highly desirable, but would require a considerable period of transition. Conversion in the sand and gravel industry would necessitate minor adjustments. Weighing equipment would have to be modified and prices adjusted. Aggregate sizes and gradations would have to be restated; producers would probably have to modify sizing equipment.

Conversion in the ready mixed concrete industry would be more involved and expensive. Equipment and rating of truck mixers would have to be modified. Measuring and metering systems in batching plants would have to be modified. An efficient means would have to be devised to use existing equipment without violating established engineering principles.

Both industries use heavy industrial and construction equipment and, therefore, the most serious problems would be in maintenance operations and establishing compatibility of long lived equipment with new replacement components.

NATIONAL SMALL BUSINESS ASSOCIATION

The Association has taken no official stand regarding metric usage. The National Small Business Association's Executive Committee has approved formation of a special ad hoc committee on U.S. metrication to study the issue.

The Association representative, as president of a typical small company which designs, manufactures and markets worldwide various kinds of capital equipment for the converting and packaging industries, offered the following thoughts: there is a growing trend toward internationalism; 17,000 small manufacturers are exporters. Metrication in the United States is inevitable. It would be a major cost for small business. An advantage of the metric system would be that when the consumer understands it, its simplicity would enhance the marketability of goods. Conversion would afford an opportunity to simplify and strengthen standards on fasteners, etc. Since metrication is inevitable, it should begin now.

PACKAGING MACHINERY MANUFACTURERS INSTITUTE

At present, about 76 percent of the companies use customary units only, while 24 percent use both customary and metric units. The metric system is used where necessary in foreign operations.

A changeover is generally acknowledged as inevitable. Metric education should be increased now and a U.S. goal should be announced. Industries should establish standing committees available for inter-industry liaison (PMMI has established such a committee). Federal assistance would be desirable, possibly including coordination and consultation services and tax relief.

SOCIETY OF AMERICAN FORESTERS

Timber and logs are measured in units derived from customary units but the system is cumbersome and confusing. A large group in the Society believes that both timber and log measurement systems must be modernized as well as the standards based upon them. Metrication would provide the opportunity to do this.

A change to the metric system in land measurements would not be appealing since it would be highly complicated and very susceptible to error.

Forest products, lumber and paper trades are intricately meshed with those in Canada. Changes in England and Canada will make change in the United States inevitable.

THE TELEPHONE GROUP OF ANSI

Present unit usage can be divided into two categories: electrical which uses metric units, and nonelectrical which uses customary units. Under a program of planned metrication, nonelectrical areas could convert within a 10-year period. Training personnel to "think metric" would be a problem.

but not severe. Maintenance of existing facilities could impose a dual inventory situation which might last 30 to 40 years.

WATER POLLUTION CONTROL FEDERATION

The Federation enthusiastically supports conversion by the United States to the metric system over a reasonable transition period. In 1963 the Federation's Executive Board voted to encourage U.S. conversion to metric units. Since 1963 all papers published in the Federation's journal have included metric equivalents following any figure stated in English units. The same practice has been followed in all Federation manuals.

The chemistry and biology oriented personnel in research and water quality analysis, and in treatment plant laboratories, have already adopted the metric system. Facilities and equipment remain in the customary system.

Appendix 1

Public Law 90-472

An Act

82 STAT. 693

To authorize the Secretary of Commerce to make a study to determine the advantages and disadvantages of increased use of the metric system in the United States.

Metric system. Study.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Commerce is hereby authorized to conduct a program of investigation, research, and survey to determine the impact of increasing worldwide use of the metric system on the United States; to appraise the desirability and practicability of increasing the use of metric weights and measures in the United States; to study the feasibility of retaining and promoting by international use of dimensional and other engineering standards based on the customary measurement units of the United States; and to evaluate the costs and benefits of alternative courses of action which may be feasible for the United States.

Investigation and appraisal requirements.

Sec. 2. In carrying out the program described in the first section of this Act, the Secretary, among other things, shall—

(1) investigate and appraise the advantages and disadvantages to the United States in international trade and commerce, and in military and other areas of international relations, of the increased use of an internationally standardized system of weights and measures;

(2) appraise economic and military advantages and disadvantages of the increased use of the metric system in the United States or of the increased use of such system in specific fields and the impact of such increased use upon those affected;

(3) conduct extensive comparative studies of the systems of weights and measures used in educational, engineering, manufacturing, commercial, public, and scientific areas, and the relative advantages and disadvantages, and degree of standardization of each in its respective field;

(4) investigate and appraise the possible practical difficulties which might be encountered in accomplishing the increased use of the metric system of weights and measures generally or in specific fields or areas in the United States;

(5) permit appropriate participation by representatives of United States industry, science, engineering, and labor, and their associations, in the planning and conduct of the program authorized by the first section of this Act, and in the evaluation of the information secured under such program; and

(6) consult and cooperate with other government agencies, Federal, State, and local, and, to the extent practicable, with foreign governments and international organizations.

Results of changes in measurement system.

Sec. 3. In conducting the studies and developing the recommendations required in this Act, the Secretary shall give full consideration to the advantages, disadvantages, and problems associated with possible changes in either the system of measurement units or the related dimensional and engineering standards currently used in the United States, and specifically shall—

(1) investigate the extent to which substantial changes in the size, shape, and design of important industrial products would be necessary to realize the benefits which might result from general use of metric units of measurement in the United States;

(2) investigate the extent to which uniform and accepted engineering standards based on the metric system of measurement units are in use in each of the fields under study and compare the extent to such use and the utility and degree of sophistication of such metric standards with those in use in the United States; and

(3) recommend specific means of meeting the practical difficulties and costs in those areas of the economy where any recommended change in the system of measurement units and related dimensional and engineering standards would raise significant practical difficulties or entail significant costs of conversion.

Report to Congress.

Sec. 4. The Secretary shall submit to the Congress such interim reports as he deems desirable, and within three years after the date of the enactment of this Act, a full and complete report of the findings made under the program authorized by this Act, together with such recommendations as he considers to be appropriate and in the best interests of the United States.

Funds.

Sec. 5. From funds previously appropriated to the Department of Commerce, the Secretary is authorized to utilize such appropriated sums as are necessary, but not to exceed $500,000, to carry out the purposes of this Act for the first year of the program.

Expiration date.

Sec. 6. This Act shall expire thirty days after the submission of the final report pursuant to section 3.

Approved August 9, 1968.

Appendix 2

GLOSSARY

1. *Customary System:* the system of measurement units (yard, pound, second, degree Fahrenheit, and units derived from these) most commonly used in the United States. Often referred to as the "English system" or the "U.S. system." Our customary system is derived from, but not identical to, the "Imperial system"; the latter has been used in the United Kingdom and other English-speaking countries, but is being abandoned in favor of the metric system.

2. *Metric System:* the measurement system that commonly uses the meter for length, the kilogram for mass, the second for time, the degree Celsius (same as "Centigrade") for temperature, and units derived from these. This system has evolved over the years and the modernized version today is identified as the "International System of Units," which is abbreviated "SI."

3. *International System of Units (SI):* popularly known as the modernized metric system, it is the coherent system of units based upon and including the meter (length), kilogram (mass), second (time), kelvin (temperature), ampere (electric current), and candela (luminous intensity), as established by the General Conference on Weights and Measures in 1960, under the Treaty of the Meter. A seventh unit, the mole (for amount of substance) is being considered as another SI base unit. The radian (plane angle) and the steradian (solid angle) are supplemental units of the system.

4. *Metrication:* any act tending to increase the use of the metric system (SI), whether it be increased use of metric units or of engineering standards that are based on such units.

5. *Planned Metrication:* metrication following a coordinated national plan to bring about the increased use of the metric system in appropriate areas of the economy and at appropriate times. The inherent aim of such a plan would be to change a nation's measurement system and practices from primarily customary to primarily metric.

6. *Cost of Metrication:* that increment of cost, monetary or otherwise, directly attributable to metrication over and above any costs that would have been incurred without metrication.

7. *Benefits of Metrication:* monetary and other advantages accruing as a result of increased use of the metric system.

8. *Measurement Standard:* a device or physical phenomenon that is used to define or determine a characteristic of a thing in terms of a unit of measurement established by authority. Examples are gage blocks, weights, thermometers, and mean solar day.

9. *Engineering Standard:* a practice established by authority or mutual agreement and described in a document to assure dimensional compatibility, quality of product, uniformity of evaluation procedure, or uniformity of engineering language. Examples are documents prescribing screw thread

dimensions, chemical composition and mechanical properties of steel, dress sizes, safety standards for motor vehicles, methods of test for sulphur in oil, and codes for highway signs. Engineering standards are often designated in terms of the level of coordination by which they were established (e.g., company standards, industry standards, national standards).

CONFERENCE PROGRAMS

This appendix contains the agenda for the seven National Metric Study Conferences held between August and November 1970.

(1) Engineering-Related Industry – August 17-21, 1970.
(2) Consumer-Related Industry – September 21-25, 1970.
(3) Construction Industry – October 5-6, 1970.
(4) Consumer Affairs – October 12-13, 1970.
(5) Education – October 14-15, 1970.
(6) Labor – October 27, 1970.
(7) Natural Resources, Transportation, Health, Small Business and Others – November 16-19, 1970.

ENGINEERING-RELATED INDUSTRY CONFERENCE

Co-Sponsored by the U.S. Department of Commerce, National Bureau of Standards, and the Engineering Foundation, Deerfield, Massachusetts

August 17-21, 1970

Monday, August 17

9:00–10:15 *Opening Session:* Chairman, Francis L. LaQue, President, American National Standards Institute
"The U.S.A. Metric Study", Lewis M. Branscomb, Director, National Bureau of Standards
"Mission of the National Metric Advisory Panel", Louis F. Polk, Chairman, National Metric Advisory Panel

10:30–12:00 *Session One:* Petroleum Refining and Related Industries, Chemicals and Allied Products and Plastics
Session Chairman: Roy P. Trowbridge
Participants: American Institute of Chemical Engineers
American Institute of Mining, Metallurgical and Petroleum Engineers
American Petroleum Institute
Manufacturing Chemists Association
Society of the Plastics Industry, Inc.

2:00– 4:00 *Session Two:* Primary Metal Industries; Rubber and Miscellaneous Plastic Products; Concrete Products
Session Chairman: William K. Burton
Participants: Aluminum Association
American Concrete Institute
American Iron and Steel Institute
Copper Development Association
Rubber Manufacturers Association

4:00– 5:00 *Session Three:* National Engineering and Standards Societies
Session Chairman: William K. Burton
Participants: American National Standards Institute
American Society for Engineering Education
American Society for Testing and Materials

7:00– 8:00 *Evening Session:* Activities of ISO Technical Committee 12 (Quantities, units, symbols, conversion factors and conversion tables) and Its Plans for the Development of Appropriate Engineering Conventions for Use of SI and Related Units
Guest Speaker: Mrs. Vibeke Simonsgaard, Deputy Director, Danish Standards Institute, Hellerup, Denmark

Tuesday, August 18

9:00–11:00 *Session Four:* Fabricated Metal Products
Session Chairman: Francis L. LaQue
Participants: Can Manufacturers Institute, Inc.
Industrial Fasteners Institute
National Screw Machine Products Association
U.S. Machine, Tapping, Wood, and Cap Screw Bureaus

11:00–12:00 *Session Five:* Mechanical and Manufacturing Societies
Session Chairman: Francis L. LaQue
Participants: American Society of Mechanical Engineers
Society of Manufacturing Engineers

7:00– 9:00 *Sessions Six and Seven:* Professional, Scientific, and Controlling Instruments
Session Chairman: Jeffrey V. Odom
Participants: Instrument Society of America
Scientific Apparatus Makers Associations

Wednesday, August 19

9:00–12:00 *Session Eight:* Machinery (except Electrical)
Session Chairman: Roy P. Trowbridge
Participants: American Society of Agricultural Engineers
American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.
Anti-Friction Bearing Manufacturers Association, Inc.
Farm and Industrial Equipment Institute
National Fluid Power Association
National Machine Tool Builders Association

2:00– 5:00 *Session Nine:* Electrical Machinery
Session Chairman: William K. Burton
Participants: Association of Home Appliance Manufacturers
Business Equipment Manufacturers Association, Inc.
Electronic Industries Association
Institute of Electrical and Electronics Engineers, Inc.
National Electrical Manufacturers Association

7:00– 8:00 *Evening Session:* The Degree of Acceptance of SI Units by European Industry as the Basis for Current and Future Engineering Standards and Practices
Guest Speaker: Nikolaus Ludwig, Director, Deutscher Normenausschuss (German Standards Institute), Berlin, Germany

Thursday, August 20

9:00–12:00 *Session Ten:* Transportation Equipment
Session Chairman: Jeffrey V. Odom
Participants: American Bureau of Shipping
American Railway Car Institute
Automobile Manufacturers Association
Shipbuilders Council of America
Society of Automotive Engineers
Society of Naval Architects & Marine Engineers

Friday, August 21

9:00–12:00 *Closing Session:* "The Significance of the Metric Study Conferences in the Total Study Program"—Daniel V. De Simone, Director, U.S. Metric Study, National Bureau of Standards
Conference Summary: Roy P. Trowbridge
Individual Statements by Attendees
Closing Remarks: William K. Burton and Jeffrey V. Odom

CONSUMER-RELATED INDUSTRY CONFERENCE

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards,
Washington, D.C., September 21-25, 1970

Monday, September 21

9:30-10:30 *Opening Session:* Chairman, Daniel V. DeSimone, Director, U.S. Metric Study

Welcome—Maurice H. Stans, Secretary of Commerce

"The National Bureau of Standards and Its Responsibilities Under the Metric Study Act"—Lawrence M. Kushner, Deputy Director, National Bureau of Standards

"The National Metric Advisory Panel as a Participant in the U.S. Metric Study"—Louis F. Polk, Chairman of the Advisory Panel

10:45-12:00 *Session One:* Wholesale Trade, General Retail Trade
Participants: National Association of Wholesalers
National Retail Merchants Association

1:30- 3:00 *Session Two:* Automatic Merchandising, Appliance Sales and Service, Toy Manufacturing
Participants: Toy Manufacturers of America
National Automatic Merchandising Association
National Appliance and Radio-TV Dealers Association

Tuesday, September 22

9:30-12:00 *Session Three:* Publishing and Book Manufacturing, Quality Control
Participants: Association of American Publishers
Book Manufacturers Institute
American Society for Quality Control

Wednesday, September 23

9:30-12:00 *Session Four:* Food Processing
Participants: Institute of Food Technologists
National Soft Drink Association
American Meat Institute
American Frozen Food Institute
National Canners Association
Milk Industry Foundation
The Salt Institute

1:30- 3:30 *Session Five:* Food Sales, Scale Manufacturing, Paper Manufacturing
Participants: National Association of Food Chains
Scale Manufacturers Association
American Paper Institute

Thursday, September 24

9:30–12:00 *Session Six:* Amusements, Motels
Participants: National Collegiate Athletic Association
American Association of Museums
Motion Picture Association of America
Theatre Equipment Supply Manufacturers Association
Society of Motion Picture & TV Engineers

1:30– 3:30 *Session Seven:* Textile Mill Products, Apparel Manufacturing
Participants: American Textile Manufacturers Institute
American Apparel Manufacturers Association
American Footwear Manufacturers Association

Friday, September 25

9:30–12:00 *Session Eight:* Automobile Sales and Service, Special Foreign Trade Report
Participants: National Automobile Dealers Association
Independent Garage Owners of America
Commerce and Industry Association of New York

CONSTRUCTION INDUSTRY CONFERENCE

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards,
Gaithersburg, Maryland, October 5-6, 1970

Monday, October 5

9:30–10:15 *Opening Session:* Chairman Daniel V. DeSimone, Director, U.S. Metric Study

Welcome—"The National Bureau of Standards and Its Responsibilities Under the Metric Study Act"—Lawrence M. Kushner, Deputy Director, National Bureau of Standards

"The Construction Industry and the Metric System"—Douglas Whitlock; Whitlock, Markey & Tait; member, Metric System Study Advisory Panel

10:30–12:30 *Session One:* Building Design, Codes, and Standards

Participants: American Institute of Architects
Consulting Engineers Council of the U.S.A.
Building Officials Conference of America, Inc.
International Conference of Building Officials

1:30– 4:30 *Session Two:* Building Materials, Production and Sales

Participants: American Concrete Institute
National Concrete Masonry Association
Structural Clay Products Institute
National Forest Products Association
California Redwood Association
American Plywood Association

Tuesday, October 6

9:30–11:15 *Session Three:* General Contractors and Subcontractors

Participants: Associated General Contractors of America
National Constructors Association
Gypsum Drywall Contractors International
International Association of Wall and Ceiling Contractors

11:15–12:00 *Session Four:* Building Services

Participants: National Electrical Contractors Association, Inc.
Air Conditioning and Refrigeration Institute

1:00– 2:00 *Session Five:* Home Builders and Home Manufacturers

Participants: National Association of Home Builders
Mobile Home Manufacturers Association

2:15– 4:30 *Session Six:* Land Services and Heavy Construction

Participants: American Land Title Association
American Society of Civil Engineers
American Road Builders Association

NATIONAL METRIC STUDY CONFERENCE—CONSUMER AFFAIRS

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards,
In Cooperation With The American Home Economics Association
Gaithersburg, Maryland, October 12-13, 1970

October 12

9:00–10:15 *Welcome Session:* Chairman: Daniel V. DeSimone, Director, U.S. Metric Study, National Bureau of Standards
"Goals of the U.S. Metric Study": Lewis M. Branscomb, Director, National Bureau of Standards
Keynote Address: "The Consumer's Interest in Metrication" The Honorable Virginia Knauer, Special Assistant to the President on Consumer Affairs
"Home Economics and the Metric Issues": Mercedes Bates, President, American Home Economics Association, Director of Betty Crocker Kitchens and Vice President of General Mills, Inc.

10:30–12:30 *Clothing:* Presiding—Mattie Waymer, Head, Home Economics Department, Morris Brown College
Purchasing Women's Ready-to-Wear: Margaret Warning, Professor and Head, Textiles and Clothing, College of Home Economics, Iowa State University
Purchasing Children's Clothing: Elsie Williams, Assistant Professor, Textiles and Clothing, College of Home Economics, Iowa State University
Purchasing Men's Clothing: Margaret Boyle, Professor and Head, Textiles and Clothing, School of Home Economics, Purdue University
Home Sewing, Yard Goods and Patterns: Mildred G. Ryan, Vice President, The McCall Pattern Company

12:30– 2:00 Lunch: NBS Cafeteria

2:00– 3:30 *Food:* Presiding—Charles Cavagnaro, Director of Field Operations, President's Committee on Consumer Interests
Purchasing Processed Food: Jean Phillips, Associate Professor, Department of Human Nutrition and Foods, College of Home Economics, Virginia Polytechnic Institute and State University
Purchasing Fresh Foods: Marjorie M. Merchant, Associate Professor, Extension Management and Family Economics, University of Massachusetts

3:45– 5:00 Presiding: Betty Lou Johnson, Chairman, Home Economics in Homemaking Section, American Home Economics Association
Food Preparation: Recipes and Their Conversion
Fern Hunt, Associate Professor, Department of Home Economics, The Ohio State University. Eloise Green, Professor of Food and Nutrition, School of Home Economics, The Ohio State University
Kitchen Equipment: Helen Goetz, Chairman, Department of Home Management, Consumer Economics and Equipment, School of Home Economics, University of Alabama

October 13

9:00–10:00 *England's Experience in Converting to Metric:* Presiding—Jeffrey V. Odom, Manager, National Metric Study Conference Program, National Bureau of Standards

Faith Prior, Extension Family Economist and Assistant Professor, University of Vermont

John Buchanan, Research Officer, The Consumer Council, 3 Cornwall Terrace, London, NW. 1, England

10:30–12:30 *The Home:* Presiding—Richard L. D. Morse, Head, Family Economics, Kansas State University

Purchase and Use of Household Equipment: Mary Purchase, Associate Professor, Home Economics and Management, New York State College of Human Ecology, Cornell University

Purchase and Use of Household Furnishings: Stanley Slom, Editor, Home Furnishings Daily

Home Repairs and Services: Henry N. Ostborg, Manager, Electro-Mechanical Division, Merchandising, Testing and Development Laboratories; Sears, Roebuck & Co.

Home Health and Safety: Wallace Janssen, Information Officer, Food and Drug Administration

12:30– 2:00 Lunch

2:00– 3:00 *Transportation:* Presiding—Louise Young, Former President, American Council on Consumer Interests, Extension Specialist in Family Economics, School of Family Resources, University of Wisconsin

Automobile Purchasing and Use: Harry Murphy, Chairman, Department of Marketing, University of Dayton

Automobile Repairs and Servicing: Herbert Ellinger, Associate Professor, Transportation Technology, Western Michigan University

3:00– 4:00 *Consumer Attitudes:* Presiding—Louise Young, Former President, American Council on Consumer Interests, Extension Specialist in Family Economics, School of Family Resources, University of Wisconsin

Theodore Dunn, Consumer Attitudes and Education, Vice President and Director of Research, Benton and Bowles

Margaret Dana, Consultant on Consumer Attitudes and Opinions, Research Center, Doylestown, Pennsylvania

4:00– 5:00 *Summary and Evaluation:* Presiding—Louise Young, Former President, American Council on Consumer Interests, Extension Specialist in Family Economics, School of Family Resources, University of Wisconsin

Robert L. Smith, Assistant Director, Consumers Union of U.S., Inc.

Doris Hanson, National Metric Advisory Panel and Executive Director, American Home Economics Association

NATIONAL METRIC STUDY CONFERENCE ON EDUCATION

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards, Gaithersburg, Maryland, October 14-15, 1970

Wednesday, October 14

9:30 *Opening Session*

Chairman: Daniel V. DeSimone, Director, U.S. Metric Study, National Bureau of Standards

"Goals of the U.S. Metric Study"—Lewis M. Branscomb, Director, National Bureau of Standards

10:00 *Curriculum Development*

Intermediate Science Curriculum Study: Ernest Burkman
Education Development Center: Judson B. Cross
American Association for the Advancement of Science: Arthur Livermore
Project QPS: Sherwood Githens, Jr.

12:00 Lunch—NBS Cafeteria

1:00 *Special Session*

"Metrication and Education", Professor Jerrold R. Zacharias, Institute Professor, Massachusetts Institute of Technology

1:30 *Higher Education*

American Society for Engineering Education: Cornelius Wandmacher
American Chemical Society: Stephen J. Quigley
American Institute of Physics: Lewis Slack
Mathematical Association of America: Alfred B. Willcox
American Institute of Biological Sciences: Dr. John W. Thornton
American Geological Institute: F. D. Holland, Jr.

4:00 *Support Activities*

American Library Association: Don S. Culbertson
NEA Division of Adult Education Service: Richard W. Cortright
Association of American Publishers: Paul Millane

Thursday, October 15

9:30 *Elementary and Secondary Education*

National Education Association: Allan West and I. A. Booker
National Council of Teachers of Mathematics: Charles Hucka
National Science Teachers Association: Bobby J. Woodruff
American Industrial Arts Association: Edward Kabakjian
Association for Educational Communications and Technology: Richard G. Nibeck
Council for Exceptional Children: Carol Fineblum
National Association of Secondary School Principals: John F. Kourmadas

12:15 **Lunch**

1:30 *Vocational and Technical Education*

American Vocational Association:

- Agricultural Education: C. M. Lawrence
- Business Education: Harry Huffman
- Distributive Education: Neal Vivian
- Guidance Education: Charles G. Foster
- Health Occupations: Dale F. Petersen
- Home Economics Education: Alleene Cross
- Industrial Arts Education: Orville Nelson
- New & Related Services: Donna Seay
- Technical Education: Frank Juszli
- Trade & Vocational Education: Lee W. Ralston

4:00 *Summary and Evaluation*

Berol Robinson, Chief Executive Officer, Education Research Center, Massachusetts Institute of Technology

NATIONAL METRIC STUDY CONFERENCE ON LABOR

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards,
In Cooperation with the American Federation of Labor—
Congress of Industrial Organizations
Gaithersburg, Maryland, October 27, 1970

9:30 *Opening Session:* Chairman: Daniel V. DeSimone, Director U.S. Metric Study, National Bureau of Standards

"Goals of the U.S. Metric Study"—Lewis M. Branscomb, Director, National Bureau of Standards

"Labor's Interest in Metrication"—Nathaniel Goldfinger, Director of Research, American Federation of Labor—Congress of Industrial Organizations

10:45-12:15 *Session One:*

Chemical, Oil, Mining, Pharmaceutical: Chic St. Croix, Oil, Chemical, and Atomic Workers International Union

United Mine Workers, Graham N. McKelvey

Construction: Thomas Hannigan, International Brotherhood of Electrical Workers

Textile, Garment: John B. Weiser, Textile Workers Union of America

12:15 Lunch—NBS Cafeteria

1:30- 4:30 *Session Two:*

Transportation, Maritime: Bert Gottlieb and Robert Franco, Transportation Institute

Air Line Pilots Association: William B. Cotton

Arts-Engineering, Printing: Howard Sullivan

Metals: Albert Epstein, International Association of Machinists and Aerospace Workers

Service: Tony Weinlein, Service Employee's International Union

Glass, Ceramic and Other: Raymond McDonald, Allied Industrial Workers of America, International Union

NATIONAL METRIC STUDY CONFERENCE ON NATURAL RESOURCES, TRANSPORTATION, HEALTH, SMALL BUSINESS AND OTHERS

Sponsored by the
U.S. Department of Commerce, National Bureau of Standards, Gaithersburg, Maryland, November 16-19, 1970

Monday, November 16

9:30-10:45 *Opening Session:* Chairman, Daniel V. DeSimone, Director, U.S. Metric Study, National Bureau of Standards

"The United States in a Metric World", Richard O. Simpson, Deputy Assistant Secretary of Commerce for Product Standards

"Metrication: What Would it Mean for America?", Lewis M. Branscomb, Director, National Bureau of Standards

"Going Metric in the United Kingdom", Gordon Bowen, Director, British Metrication Board

11:00-11:15 *Special Session:* "Metrication and the National Metric Advisory Panel", Louis M. Polk, Chairman, National Metric Advisory Panel

11:15-12:30 *Session One:* Legal Services, Communications
Participants: American Bar Association
Telephone Group—ANSI
National Association of Broadcasters

1:30- 4:30 *Session Two:* Agriculture, Forestry, Fisheries, Mining
Participants: American Farm Bureau Federation
National Farmers Union
American Agricultural Economic Association
Society of American Foresters
National Fisheries Institute
American Mining Congress

Tuesday, November 17

9:30- 3:00 *Session Three:* State and Local Government
Participants: Council of State Governments—National Governors Conference
International City Management Association—National League of Cities—U.S. Conference of Mayors
National Association of Counties

1:30- 2:30 *Session Four:* Finance
Participants: National Association of Securities Dealers
Associated Credit Bureaus of America

2:30- 3:00 *Special Session:* Metric Association, Inc.

3:00- 4:30 *Session Five:* Small Business
Participants: National Federation of Independent Business
National Small Business Association

Wednesday, November 18

9:30-12:00 *Session Six:* Transportation and Related Services

Participants:
American Warehousemen's Association
American Trucking Association
American Transit Association
Institute of Traffic Engineers
Packaging Machinery Manufacturers Institute
American Institute of Merchant Shipping
Air Transport Association
Association of Oil Pipelines

Thursday, November 19

9:30-10:00 *Special Session:* American Institute of Certified Public Accountants

10:15-12:30 *Session Seven:* Medical Services

Participants:
American Medical Association
American Dental Association
American Public Health Association
American Optometric Association
American Nurses Association
American Hospital Association
American Pharmaceutical Association
National Association of Retail Druggists

Appendix 4

MEMBERS OF THE METRIC SYSTEM STUDY ADVISORY PANEL WHO SERVED ON DISCUSSION PANELS

CONSUMER-RELATED INDUSTRY CONFERENCE

Harold Berryhill, Principal, Central City High School, Central City, Iowa

John F. Clark, President and General Manager, Sunbeam Appliance Service Company

Jackson K. Emery, President, Accumet Engineering Corporation

Gordon A. Goodrich, Director of Production Engineering, General Foods Corporation

James A. Graham, Vice President, Corporate Planning & Development, Standard Pressed Steel Company

Thomas Hannigan, Director of Research and Education, International Brotherhood of Electrical Workers

Doris Hanson, Executive Director, American Home Economics Association

William J. Harris, Jr., Vice President, Association Research and Test Department, Association of American Railroads

O. Dean Hubbard, Vice President and Assistant to the President, Kimbell, Inc.

Herbert B. McKean, Vice President, Research and Development, Potlatch Forests, Inc.

William D. Rinehart, Assistant General Manager, American Newspaper Publishers Association, Research Institute, Inc.

Elton E. Staples

Also: **William K. Burton,** Metric System Development Manager, Engineering Staff, Ford Motor Company

CONSTRUCTION CONFERENCE

Sheldon I. Euler, President, Information Records Division, IBM Corporation

Thomas Hannigan, Director of Research and Education, International Brotherhood of Electrical Workers

Charles C. Neas, Union Carbide Corporation

Ivan A. Peters, Vice President, Title Insurance & Trust Company

Douglas Whitlock, Partner, Reed, Smith, Shaw & McClay

Also: **William K. Burton,** Metric System Development Manager, Engineering Staff, Ford Motor Company

CONSUMER AFFAIRS CONFERENCE

Harold Berryhill, Principal, Central City High School, Central City, Iowa

Philip T. Bodell

John Clark, President and General Manager, Sunbeam Appliance Service Company

Gordon A. Goodrich, Director of Production Engineering, General Foods Corporation

Ethel Langtry, Ethel Langtry Consultants, Inc.

EDUCATION CONFERENCE

Harold Berryhill, Principal, Central City High School, Central City, Iowa

Thomas Hannigan, Director of Research and Education, International Brotherhood of Electrical Workers

Robert W. Sullivan, Executive Vice President, The Valve Manufacturers Association

Samuel H. Watson, Jr., Manager of Standardizing, Radio Corporation of America

Also: **William K. Burton,** Metric System Development Manager, Engineering Staff, Ford Motor Company

LABOR CONFERENCE

Harold Berryhill, Principal, Central City High School, Central City, Iowa

Clay Buckhout

Thomas Hannigan, Director of Research and Education, International Brotherhood of Electrical Workers

Roy P. Trowbridge, Director, Engineering Standards Section, General Motors Corporation

NATURAL RESOURCES, TRANSPORTATION, HEALTH, SMALL BUSINESS AND OTHERS

Harold Berryhill, Principal, Central City High School, Central City, Iowa

Clay Buckhout

Robert J. Friedrich, Manager, Metallurgical Sales, Consolidation Coal Company

W. Eugene Hamilton, American Farm Bureau Federation

Harold F. Hammond, President, Transportation Association of America

William A. McAdams, Manager, Industry Standards, General Electric Company

Douglas C. Strain, President, Electro-Scientific Industries, Inc.

Liston A. Witherill, Chief Deputy Director, Los Angeles County Department of Hospitals

Also: **William K. Burton,** Metric System Development Manager, Engineering Staff, Ford Motor Company

FEDERAL REGISTER NOTICE

Federal Register Volume 35, Number 99, Pages 7827-8, Thursday, May 21, 1970

REQUEST FOR INPUTS TO THE NATIONAL METRIC STUDY

Under the provisions of Public Law 90-472, the Secretary of Commerce is directed to make a report, together with such recommendations as he deems appropriate, to the Congress concerning what action, if any, should be taken in the United States with respect to the increasing worldwide and domestic use of the metric system.

The U.S. Metric Study, at the National Bureau of Standards, in response to this directive, is seeking answers from all sectors of the economy to the following key questions: (1) What is the present impact within the United States of increasing worldwide and domestic use of the metric system? (2) What would this impact be in the future, assuming the use of the metric system continues to increase with no coordination among the various sectors of the society? (3) What would be the effect of a coordinated national program to increase the use of the metric system?

Prior to the submission of the final report to the Congress in August 1971, it is essential to insure that proper consideration be given the viewpoints of all sectors of the economy regarding these key questions. The purpose of this notice is to solicit such viewpoints from trade associations, labor organizations, professional, scientific and engineering societies, and other similar organizations. This information will be considered along with the reports of the National Metric Study Conferences which will be conducted during the summer and fall of 1970.

To receive proper consideration, all submittals must be received by September 30, 1970. Interested parties should direct inquiries about submittals or the Conference program to the Manager, National Conferences Program, U.S. Metric Study, Washington, D.C. 20234.

Lewis M. Branscomb, *Director*

May 5, 1970

GUIDELINES FOR SUBMITTALS TO THE U.S. METRIC STUDY

1. General Guidelines
2. Labor Guidelines
3. Consumer Guidelines
4. Education Guidelines

GENERAL GUIDELINES FOR PREPARATION OF REPORTS FOR SUBMITTAL TO THE NATIONAL METRIC STUDY CONFERENCES

INTRODUCTION

The U.S. Metric Study is being conducted at the National Bureau of Standards to determine what action, if any, should be taken in the United States with respect to the increasing worldwide and domestic use of the metric system. The study is being conducted on behalf of the Secretary of Commerce pursuant to Public Law 90-472. In this connection, the Bureau is holding a series of National Metric Study Conferences at which your organization has agreed to participate. This participation will involve the preparation of a written document as described below and a verbal summary of this document at one of the conferences. The speaker at the conference should also be prepared to respond on behalf of your organization to any questions that may be raised.

The following guidelines for the written submittals are presented only for the purposes of achieving substantial uniformity and completeness among the large number of responses to be received. The guidelines are not meant to be exclusive, and your organization is free to submit any additional information within the scope of the study as may appear appropriate to you. It is hoped that you will give consideration to all the information given below, since your input will be the major source of industry-level information to the U.S. Metric Study for your industry. Associations, whenever feasible and possible, should poll their memberships in order to develop a consensus as to the appropriate answers for the entire industry.

I. General Information

1. Name and address of organization preparing submittal.
2. Name, title, and address of the representative of the organization responsible for the contents of this submittal.
3. Name, title, and address of the person, if different from the representative identified above, who will appear at the National Conferences.
4. A brief description of the nature of the organization, including a description of its membership (attach a list if possible).

5. Indicate the percentage of membership, if any, consulted in the preparation of the answers in this submittal.

II. Present Status

The following information will enable the Study Group to determine the present status of your industry regarding measurement system usage.

A. Measurement System Usage

1. Describe the systems of weights and measures in use in your industry (customary or metric). If more than one system is in use explain where each is in use and why. Be sure to describe what system of units is used in your engineering standards, if applicable.
2. State whether there have been any recent changes in usage in your industry. Explain where and why.
3. State whether or not there are any planned changes in unit usage in your industry. Is there any desire to change? Explain where and why.

B. Prior Conversion

If any of the firms in your industry have increased their use of the metric system (either metric units or standards), please supply the following information if it is available.

(1) Describe the factors that were instrumental in their decision to increase the use of the metric system.
(2) Describe the advantages that were experienced.
(3) Describe the difficulties that were experienced.
(4) If the Metric Study Group can contact any such firms for more detailed information concerning their experiences, please list their name, address, and the name of an appropriate person to contact.

C. Experiences with other Countries

If your association or any of its member firms have any information concerning metrication plans or experience of other countries especially as it relates to your industry, please summarize this information and, if possible, attach copies.

D. Present and Past Effects of Increasing Metric Usage

The use of the metric system is and has been increasing both around the world and within the United States. Please discuss any effects such increasing usage (units and/or standards) has had or may be having on your industry.

III. Possible Future Effects Assuming Alternative Courses of Action

A. Evolutionary Metrication

Please describe what effects the continued increasing worldwide and domestic use of the metric system (units and/or standards) in the future *might* have on your industry, assuming that there is *no program of coordination* or encouragement by the Federal Government.

B. Planned Metrication

Please describe what the effects of a *planned program* to increase the use of the metric system would be on your industry. Consider two separate periods of time for the planned program: a variable time period and a fixed time period. The variable time period is defined as that period of time in which a change to predominant usage of metric units and engineering standards based on such units can be accomplished at minimum cost and disruption for your industry. This is called the "optimum time period." The fixed time period for this study has been set at 10 years. Please describe the probable effects of planned metrication on your industry for both the "optimum" period and the assumed 10-year period, and summarize any differences.

In describing the effects, please consider: (1) A change in units (language) only (see assumption 5 below), and (2) a change in language and standards (see assumptions 5 and 6 below). In your consideration of the effects of a change in standard sizes, please describe:

(a) the effects of unspecified changes in standard size(s) to standard size(s) based on the metric system.
(b) any recommendations you might have as to the optimum new standard size(s) based on the metric system.

In answering question B, the following *assumptions* regarding the program of planned metrication should be used:

(1) At the inception of the program all major countries except the United States are metric or are on the way to becoming metric.
(2) Ample time is available for planning changes.
(3) All goods and services will be available as needed at no additional cost.
(4) The metric system will be taught in all U.S. schools during the transition period and the general public will concurrently be gaining familiarity with this system of measurement.
(5) Language Changes
  a. Under the *optimum time period*, language changes are made on printed material (e.g. catalogs, deeds, labels) only as it is being revised.
  b. Under the *fixed time period of 10 years* the same changes are made as under the optimum time period but are considered to be accomplished in 10 years.

(6) Engineering Standards Changes
  a. Under the optimum time period, only new or redesigned parts and products will be changed to comply with engineering standards based on the metric system, unless there are distinct advantages in changing existing items.
  b. Under the *fixed time period of 10 years*, the same changes are

made as under the optimum time period but are considered to be accomplished in 10 years.

IV. Your Opinions

A. Please give any opinions your association may have concerning the possibility of or need for increased use of the metric system in your industry and in the United States.

B. Please give any opinions or suggestions your association may have regarding possible methods of carrying out a program of planned metrication in your industry and in the United States.

C. Please describe any opinions your association may have as to methods of alleviating the present impact of increasing worldwide and domestic use of the metric system.

D. Please describe any opinions your association may have with regard to the major problems that would be involved in metrication.

E. Please give any other opinions or suggestions that your association would like the Study Group and the Secretary of Commerce to consider as they determine what appropriate action the United States should follow with respect to the metric issue.

GENERAL GUIDELINES FOR PREPARATION OF REPORTS FOR SUBMITTAL TO THE LABOR CONFERENCE

INTRODUCTION

The U.S. Metric Study is being conducted at the National Bureau of Standards to determine what action, if any, should be taken in the United States with respect to the increasing worldwide and domestic use of the metric system. The Study is being conducted on behalf of the Secretary of Commerce pursuant to Public Law 90-472. In this connection, the National Bureau of Standards is holding a Labor Conference in cooperation with the AFL-CIO on October 27 of this year. Your participation will involve the preparation of a written report as requested below to be submitted to the U.S. Metric Study for inclusion in the final report to Congress. In addition, your organization is invited to send a representative to the Labor Conference.

To eliminate the possibility of unnecessary repetition by having each labor union or worker group present its own paper at the conference, unions and worker groups have been grouped into trades or industries. For each trade an individual has been invited to summarize the reports prepared by the unions and groups identified with the particular trade. The invitee is requested to present his summary at the Labor Conference and be available for any discussion from the floor. This arrangement has been worked out with the AFL-CIO.

The following guidelines for written submittals are presented in order to achieve a substantial degree of uniformity and completeness among the large number of responses to be received. The guidelines are not meant to be exclusive and you are free to submit any additional information within the scope of the study as may appear appropriate to you. It is hoped that your organization will give consideration to all the information given below, since your input will be a major source of information to the U.S. Metric Study for your particular trade. Please read the entire guidelines before beginning your response.

I. Past Experience of Conversion to the Metric System

If any of the workers in your union or trade have converted to or increased their use of the metric system, please supply the following information:

(1) Describe the situation which led to conversion or the increased use of the metric system.
(2) Describe the advantages and difficulties that were experienced.
(3) Indicate what worker-owned tools and equipment became obsolete

in the conversion, and if possible, approximate the cost to the worker in replacing such tools.

(4) If a training program was established, indicate the length of such program and its effectiveness.

(5) Indicate if any problems occurred in the recruitment of workers, and also the promotion of workers.

(6) Indicate whether the conversion to the metric system had any significant effects on the nature of the jobs for any types of workers.

(7) If the U.S. Metric Study Group can contact any such workers for more detailed information concerning their experience, please list the appropriate person(s) to contact, and his address.

II. Your Opinions Concerning a Possible Change to the Metric System

A. If members within your organization have not experienced conversion to the metric system, we would nonetheless appreciate your speculating as to the probable impact to them in the various industries in which you are represented. For this purpose, assume that there is a nationally planned program of 10 years to change to the metric system. This is only an assumption and does not imply that this or any other program will be adopted in this country. In answering this request, we would suggest that you consider each of the following:

(1) The advantages and disadvantages that would result from such a change.

(2) What worker-owned tools and equipment might become obsolete in a conversion, and if possible, the approximate cost to the worker in replacing such tools.

(3) What training program would need to be established and the length of such a program.

(4) Any other items listed in section I above that are applicable.

B. Please give any other opinions or suggestions that your union would like the Study Group and the Secretary of Commerce to consider as they determine what appropriate action the United States should follow with respect to the metric issue.

GENERAL GUIDELINES FOR PREPARATION OF REPORTS FOR SUBMITTAL TO THE CONSUMER CONFERENCE

INTRODUCTION

The United States Metric Study is being conducted at the National Bureau of Standards to determine what action, if any, should be taken in the United States with respect to the increasing worldwide and domestic use of the metric system. The study is being conducted on behalf of the Secretary of Commerce pursuant to Public Law 90-472. In this connection, you (your organization) have been invited to prepare a paper answering the key questions of the U.S. Metric Study as outlined below and as related to selected areas of consumer concern.

Measurement language and units enter into areas of consumer concern to varying degrees. Consequently, to determine in a systematic way how the increasing worldwide and domestic use of the metric system currently affects the consumer and how the consumer might be affected if there were a planned program to increase the use of the metric system in the United States, separate activites in which the consumer is engaged that make use of measurement language or units have been classified for detailed study.

The following guidelines for the written submittals are presented in order to achieve a substantial degree of uniformity and completeness among the responses to be received. The guidelines are not meant to be exclusive, and you are free to submit any additional information within the scope of the study as may appear appropriate to you. It is hoped that you will give consideration to all the information requested below as it relates to the activity (activites) considered since this input will be a major source of information to the U.S. Metric Study.

I. General Information

1. Name, title, and address of individual preparing submittal.
2. A brief description of the nature of the organization or background of individual preparing submittal.
3. A brief description of the activity covered and extent.
4. Indicate briefly methods used to obtain information (e.g., own experience, knowledge, and analysis; interviews; questionnaires).

Each of the following should be applied to the particular consumer activity that you are investigating.

II. Present Impact

The following information will enable the Study Group to determine the present impact of increasing metric usage.

(a) Describe the present impact that the increasing worldwide and domestic use of the metric system is having on the consumer engaged in the particular activity.

(b) Indicate where there is any general use of metric units or items made to metric engineering standards. (This would include foreign-made merchandise such as automobiles.) Indicate what problems or inconveniences the consumer has experienced and any advantages directly attributable to the units, or language, or standards used.

III. Present Status

The following information will enable the Study Group to determine the present status within the particular consumer activity regarding measurement system usage.

(a) For the particular activity indicate what system of units (either customary or metric) is used and where possible what specific units or sizes are used.

(b) Describe in each case what advantages and disadvantages exist to the consumer from using the specific units or sizes.

(c) Determine, where possible, to what extent individuals know, understand, and use the measurement system, units or sizes in use in the activity. Also, to what extent does the individual know, understand and use the metric system.

IV. Possible Future Effects Assuming Alternative Courses of Action

A. No National Program

The following information will assist the Study Group in determining what impact no national program would have on the consumer.

(1) Describe any current trends (e.g., increasing metric system usage) that exist concerning measurement language usage.

(2) Assuming that there is no program of coordination or encouragement by the Federal Government to increase the use of the metric system, describe what effects the continued increasing worldwide and domestic use of the metric system will have on the consumer engaged in the particular activity. If you can definitely foresee a change in measurement units, language, or standards, please indicate how you arrived at this fact.

B. Planned Metrication

The following information will assist the Study Group in determining what impact a planned change to the metric system would have on the consumer.

(1) If the United States were to change to predominant use of the metric system, please try to determine and describe what language, unit, and size changes would accompany such a change in the particular consumer activity. Please be as specific as possible.

(2) Please describe what effect these changes would have on the particular activity of the consumer. Please describe:
  (a) How the individual would react and be affected by the specified changes in units.
  (b) What advantages and disadvantages would accompany such a change.

(3) Try to determine if any of the advantages obtained by changing to the metric system could be achieved by changes within the customary system.
(4) If any changes were made to the use of the metric system please indicate what type of education would be helpful and necessary for the consumer. Also, indicate where and what types of conversion charts could be used.
(5) Indicate what items the individual might have to replace and the average cost. Indicate why you think these items would be replaced.

In answering the above under Planned Metrication if you have any information concerning metrication plans or experience of other countries as it relates to this particular consumer activity, please summarize this information, and if possible, attach copies.

V. Your Opinions

Please give any opinions or suggestions that you would like the Study Group and the Secretary of Commerce to consider as they determine what appropriate action the United States should follow with respect to the metric issue.

GENERAL GUIDELINES FOR PREPARATION OF REPORTS FOR SUBMITTAL TO THE EDUCATION CONFERENCE

INTRODUCTION

The U.S. Metric Study is being conducted by the National Bureau of Standards to determine what action, if any, should be taken in the United States with respect to the increasing worldwide and domestic use of the metric system. The study is being conducted on behalf of the Secretary of Commerce pursuant to Public Law 90-472. In this connection, your association is requested to prepare a document answering the key questions of the metric study as outlined below as they relate to the area of education with which you are concerned.

The following guidelines for the written submittals are presented in order to achieve a substantial degree of uniformity and completeness among the responses to be received. The information requested in these guidelines should be interpreted as being limited to that area of education that you represent, unless you care to submit additional information or opinions. There are two sections to these guidelines. Section I relates to the classroom activities, teachers, students, textbooks, teaching aids, and other items directly involved in the classroom instructional procedures. Section II deals with the related support activities of the educational institution such as record keeping, office procedures and management, support staff, catalogues, and any other factors generally related to the business activities of education. It is suggested that you consider either or both sections as they are appropriate to your association's or society's concern.

These guidelines should not be considered a questionnaire, but are an outline of the information that is sought by the U.S. Metric Study. Nor are the guidelines meant to be exclusive; you are free to submit any additional information within the scope of the study as may appear appropriate to you. It is hoped that you will give consideration to all the information outlined below, since your input will be a major source of information to the U.S. Metric Study for your particular area of education. The same guidelines are being used by all areas of education. It is realized that some of the topics below may not be relevant to your particular area or that you cannot supply some of the details requested. In such cases we would appreciate receiving a simple statement of this fact.

GENERAL INFORMATION

1. Name and address of person or organization preparing submittal.

2. Name, title, and address of the representative of the organization responsible for the contents of this submittal (if applicable).

3. A brief description of the nature of the organization, including a description of its membership (if applicable).

4. Indicate the percentage of membership, if any, consulted in the preparation of the answers in this submittal (if applicable).

Section I: Classroom Activities and Instructional Procedures

Section I is concerned with those individuals (teachers and students), classroom activities, and items directly involved in the educational process. Included are textbooks, instructional material and teaching aids, shop and laboratory equipment.

A. Present Status

The following information will enable the Study Group to determine the present status within education regarding measurement system usage and the advantages and disadvantages resulting from the use of a particular system or systems:

(1) Indicate generally by grade and course or by subject where measurement units are used or taught. Indicate in which courses the metric system is used or taught and what percent of the time is spent using the metric system compared to the total time spent using measurement units. Where the metric system is being used explain how it is being used (e.g., problem solving, actual physical measurements, in shop design and fabrication, geographical data like distance, area, elevation). If possible, cite the reasons for using or teaching the metric system.

(2) State generally whether the trend in the past few years has been to decrease, remain about the same, or increase the use of the metric system. Indicate what, in your opinion, will be the trend in the next few years.

(3) Explain what advantages and disadvantages, if any, have been experienced from teaching or using the metric system. Please describe any problems that students experience in learning or using the metric system. Describe, in your opinion, the chief sources of these difficulties. Explain any difficulties teachers have experienced in teaching or using the metric system and what you think could be done to overcome them. Explain what you see as the advantages of the metric system. Give your opinion on or discuss the results of any studies on the issue of whether or not the metric system is easier to learn and use than the customary system and whether or not time can be saved in teaching measurement concepts and working with measurement units through use of the metric system. Describe any factors outside the educational institution affecting the ability of the students to grasp measurement units taught in school. Discuss the advantages and disadvantages of using more than one measurement system. Describe any difficulties experienced by students in using more than one system. Discuss the advantages and disadvantages of using only one measurement system.

B. Possible Future Effects Assuming Alternative Courses of Action

Assuming that there is no national program to increase the use of the metric system in the United States, describe what effects the continued increasing worldwide and domestic use of the metric system would have on your area of education. Discuss any trends or changes that you foresee in use of measurement systems and what effects would result, such as changes in curriculum, textbooks, and time spent working with measurement units. Indicate why any changes are being made or anticipated.

The following information will assist the Study Group in determining what impact a nationally planned program to change to the metric system would have on education.

(1) Describe the disadvantages, costs, practical difficulties, and problems of such a planned change. Discuss whether teachers would need any training, what type, and how many hours would be necessary. If training is necessary, to what degree can this be accomplished with the teachers present schedule with minimum effort? Describe what textbooks, teaching aids, shop and laboratory equipment, and materials would have to be replaced or added above those that normally would be replaced in a 10-year period and could not be phased in on the normal replacement schedule. Where possible, *indicate the costs involved,* including training. Discuss any major changes in curriculum that would be necessary if the metric system were the main measurement system taught and used.

(2) Describe any advantages and savings that would result in education from a change to predominant use of the metric system. Discuss if any time could be saved by teaching and using the metric system as the primary measurement system.

(3) Describe what you consider is the best plan for education to change to predominant use of the metric system, how long it should take and what coordination would be necessary. Indicate what role county and state boards of education, federal and state governments should play in coordinating and directing any planned change.

(4) If you or your association have any information concerning metrication plans or experiences of other countries as it relates to education, please summarize this information and, if possible, attach copies.

C. Your Opinions

Please give your opinions or your association's official position concerning the possibility of or need for increased use of the metric system in education and in the United States.

Please give any other opinions or suggestions that you or your association or society would like the Study Group and the Secretary of Commerce to consider as they determine what appropriate action the United States should follow with respect to the metric issue.

Section II: Institutional and Business Activities of Education

Section II is concerned with those individuals (principals, deans, secretaries, support staff, etc.) and activities (office, cafeteria, health, record keeping, etc.) that are not directly involved in the classroom and educational process. These are the support activities generally related to the business side of education.

A. Present Status

The following information will enable the Study Group to determine the present status within the operations of the institutions and school systems regarding measurement system usage.

1. Measurement System Usage

a. Describe the systems of weights and measures in use (customary or metric). If more than one system is in use explain where each is in use and why.

b. State whether or not there have been any recent changes in usage. Explain where and why.

c. State whether or not there are any planned changes in unit usage. Is there any desire to change? Explain where and why.

2. Prior Conversion

If any institutions or school districts have increased their use of the metric system, please supply the following information if it is available.

(a) Describe the factors that were instrumental in their decision to increase the use of the metric system.
(b) Describe the advantages that were experienced.
(c) Describe the difficulties that were experienced.
(d) If the Metric Study Group can contact any schools or school systems for more detailed information concerning their experiences, please list their name, address, and the name of an appropriate person to contact.

3. Present and Past Effects of Increasing Metric Usage

The use of the metric system is and has been increasing both around the world and within the United States. Please discuss any effects such increasing usage has had or may be having on educational institutions and support activities.

B. Possible Future Effects Assuming Alternative Courses of Action

1. Evolutionary Metrication

Please describe what effects the continued increasing worldwide and domestic use of the metric system in the future *might* have on institutions assuming that there is no program of coordination or encouragement by the Federal Government.

2. *Planned Metrication*

Please describe what the effects of a *planned program* to increase the use of the metric system would be on institutions. Consider two separate periods of time for the planned program: a variable time period and a fixed time period. The variable time period is defined as that period of time in which a change to predominant usage of metric units and engineering standards based on such units can be accomplished in educational institutions at minimum cost and disruption. This is called the "optimum time period." The fixed time period for this study has been set at 10 years. Please describe the probable effects of planned metrication for both the "optimum" period and the assumed 10-year period, and summarize any differences. In answering question 2, the following assumptions regarding the program of planned metrication should be used:

(a) At the inception of the program all major countries except the United States are metric or are on the way to becoming metric.
(b) Ample time is available for planning changes.
(c) All goods and services will be available as needed at no additional cost.
(d) Language Changes

  1. Under the *optimum time period*, language changes are made on printed material (e.g. catalogs, deeds, labels) only as it is being revised.
  2. Under the *fixed time period of 10 years* the same changes are made as under the optimum time period but are considered to be accomplished in 10 years.

(e) Engineering Standards Changes

  1. Under the *optimum time period*, only new or redesigned parts and products will be changed to comply to engineering standards based on the metric system, unless there are distinct advantages in changing existing items.
  2. Under the *fixed time period of 10 years*, the same changes are made as under the optimum time period but are considered to be accomplished in 10 years.

FORM NBS-114A (1-71)

U.S. DEPT. OF COMM.
BIBLIOGRAPHIC DATA SHEET

1. PUBLICATION OR REPORT NO.

2. Gov't Accession No.

3. Recipient's Accession No.

4. TITLE AND SUBTITLE
Testimony of Nationally Representative Groups

5. Publication Date
July 1971

6. Performing Organization Code

7. AUTHOR(S)
Editor: Jeffrey V. Odom

8. Performing Organization

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.
4063129

11. Contract/Grant No.

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

This publication, a part of the U.S. Metric Study series, summarizes the inputs received from the more than 700 associations, societies, unions and other groups which were invited to submit their opinions and viewpoints on the issues raised by the U.S. Metric Study Act. Most of these submissions were publicly presented at hearings held during the course of the Study.

17. KEY WORDS (Alphabetical order, separated by semicolons) International System of Units; metric conversion; metric system; metric usage; metrication; metrication, attitudes toward; metrication, costs and benefits of; metrication, impact of; National Metric Study Conferences; SI; U.S. Metric Study

18. AVAILABILITY STATEMENT

☒ UNLIMITED.

☐ FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.

19. SECURITY CLASS (THIS REPORT)
UNCLASSIFIED

20. SECURITY CLASS (THIS PAGE)
UNCLASSIFIED

21. NO. OF PAGES
180

22. Price
$1.50

USCOMM-DC 66244-P71

U. S. GOVERNMENT PRINTING OFFICE : 1971 O - 426-992